

Kyri Alysa Baker, Ph.D.

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Summary Creative researcher passionate about transforming the electric power grid, inclusion and outreach, and interdisciplinary collaboration. Expertise in stochastic and distributed optimization spanning electricity markets, power grids, and buildings. Collaboration with researchers from behavioral sciences, building sciences, mathematics, and transportation. Excellent communication, analytical, and technical skills that support both theoretical and applied energy research.

Future Position **Assistant Professor** **Starting August 2017**
University of Colorado Boulder
Department of Civil, Environmental, and Architectural Engineering

Current Position **Distributed Control and Optimization of Power Systems Engineer**
National Renewable Energy Laboratory Feb. 2016 - Present.

- Led research efforts in stochastic optimization applied to distribution systems for multi-lab collaboration projects in coordination with industry partner Smarter Grid Solutions.
- Wrote a proposal as co-PI and obtained \$400,000 of funding in the combined power/water/gas optimization area.
- Received NREL's Employee of the Month award for leading control and optimization efforts and delivering a successful demo of a smart home project funded under the DOE and Bonneville Power Administration.
- Applied optimization duality theory to new areas of electricity market design.
- Contributed to the scientific community as a conference session chair, technical committee member, NSF panel reviewer, and journal/conference reviewer.
- Successfully implemented the first chance-constrained optimization on an AC Optimal Power Flow problem to ensure voltage regulation with a 99% probability.
- Mentored an undergraduate student and advised her as she wrote her first conference paper on lithium-ion battery models.

Previous Position **Postdoctoral Researcher, Residential Buildings Group**
National Renewable Energy Laboratory Jan. 2015 - Feb. 2016.

- Improved the design and implementation of a co-simulation framework for markets, transmission grids, and distribution grids which simulates hundreds of thousands of distribution feeders and individual homes and appliances.
- Collaborated with three utilities in California to perform sensitivity studies on distribution PV penetration, increasing the hosting capacity of multiple feeders.
- Designed a frequency-regulation algorithm which was implemented in a laboratory with controllable smart home appliances (water heater, HVAC, electric vehicle) using the VOLTTRON framework.
- Mentored a graduate student implementing distributed optimal power flow controllers on parallel computing platforms as part of a collaboration with start-up company ProsumerGrid.

- Education**
- Ph.D, Electrical and Computer Engineering** 2010 - Dec. 2014
Carnegie Mellon University, Pittsburgh, PA
Advisor: Prof. Gabriela Hug
Co-Advisor: Prof. Xin Li
Thesis: “Coordination of Resources across Areas for the Integration of Renewable Generation: Operation, Sizing and Siting of Storage Devices.” [[Online](#)]
- M.S., Electrical and Computer Engineering** 2009-2010
Carnegie Mellon University, Pittsburgh PA
Research Focus: Biometrics, Advised by Prof. Marios Savvides
- B.S., Electrical and Computer Engineering** 2006-2009
Carnegie Mellon University, Pittsburgh PA
Research Focus: Bioinformatics, Advised by Prof. Takeo Kanade and Dr. Mei Chen
- Grants**
- Distributed Control of Smart Multi-Energy Districts** - Advanced controls and optimization for combined power, gas, and water networks. *Laboratory Directed Research and Development*. P.I.: Emiliano Dall’Anese; Co-PI: **Kyri Baker**. \$400,000.
- Patents**
- K. Baker**, A. Bernstein, and E. Dall’Anese, “Network-Cognizant Voltage Droop Control,” *Patent Pending*.
- Publications**
- Journal Articles Published/Under Review**
- (J6) X. Jin, **K. Baker**, D. Christensen, and S. Isley, “User-Preference-Driven Model Predictive Control of Residential Resources for Demand Response,” *submitted to Applied Energy*.
- (J5) **K. Baker**, A. Bernstein, E. Dall’Anese, and C. Zhao, “Network-Cognizant Voltage Droop Control for Distribution Grids,” *submitted to IEEE Transactions on Power Systems* (under second round review). [[arXiv](#)]
- (J4) E. Dall’Anese, **K. Baker**, and T.H. Summers, “Chance-Constrained AC Optimal Power Flow for Distribution Systems with Renewables,” *IEEE Transactions on Power Systems* (to appear), 2017. [[IEEEExplore](#)]
- (J3) **K. Baker** and B. Toomey, “Efficient Relaxations for Joint Chance Constrained AC OPF,” *Electric Power Systems Research*, 148 (2017), pp. 230-236. [[Online](#)]
- (J2) **K. Baker**, G. Hug, and X. Li, “Energy Storage Sizing Taking into Account Wind Forecast Uncertainties,” *IEEE Transactions on Sustainable Energy*, Vol. 8, No. 1, pp. 331-340, Jan 2017. [[IEEEExplore](#)]
- (J1) **K. Baker**, G. Hug, and X. Li, “Distributed MPC for Efficient Coordination of Storage and Renewable Energy Sources across Control Areas,” *IEEE Transactions on Smart Grid, Special Issue on Distributed Energy Management Systems*, Vol. 7, No. 2, pp. 992-1001, Mar. 2016 (444 submissions, 20 published). [[IEEEExplore](#)]
- Conference Articles Published/Under Review**
- (C14) Y. Guo, **K. Baker**, E. Dall’Anese, Z. Hu, and T.H. Summers, “Stochastic optimal power flow based on data-driven distributionally robust optimization,” *submitted to the 2017 IEEE Conference on Decision and Control (CDC)* (Invited paper), 2017.

- (C13) **K. Baker**, A. Bernstein, C. Zhao, and E. Dall’Anese, “Network-cognizant Design of Decentralized Volt/VAR Controllers,” *accepted to 2017 Innovative Smart Grid Technologies (ISGT)*, 2017.
- (C12) X. Jin, **K. Baker**, S. Isley, and D. Christensen, “User-Preference-Driven Multi-Objective Model Predictive Control of Residential Building Loads and Battery Storage for Demand Response,” *American Controls Conference (Invited Paper)*, 2017.
- (C11) X. Zhou, L. Chen, E. Dall’Anese, and **K. Baker**. “Incentive-Based Voltage Regulation in Distribution Networks,” *American Controls Conference*, 2017.
- (C10) E. Raszmann, **K. Baker**, Y. Shi, and D. Christensen, “Modeling Stationary Lithium-Ion Batteries for Optimization and Predictive Control,” *Power and Energy Conference at Illinois (PECI)*, [**Best Paper Award**], 2017.
- (C9) E. Dall’Anese, **K. Baker**, and T.H. Summers, “Adaptive Optimal Power Flow for Distribution Systems under Uncertain Forecasts,” *2016 Conference on Decision and Control (CDC)*, Las Vegas, NV, Dec. 2016. [[Online](#)]
- (C8) **K. Baker**, X. Jin, D. Vaidhyanathan, W. Jones, D. Christensen, B. Sparr, J. Woods, H. Sorensen, and M. Lunacek, “Short Paper: Frequency Regulation Services from Connected Residential Devices,” *ACM BuildSys ’16*, Stanford, CA, Nov. 2016 (5 out of 68 Short Papers accepted). [[Online](#)]
- (C7) **K. Baker**, E. Dall’Anese, and T.H. Summers, “Distribution-Agnostic Stochastic Optimal Power Flow for Distribution Grids,” *IEEE North American Power Symposium*, Denver, CO, Sept. 2016. [[IEEEExplore](#)]
- (C6) B. Palmintier, E. Hale, B.-M. Hodge, **K. Baker**, and T. Hansen, “Experiences integrating transmission and distribution simulations for DERs with the Integrated Grid Modeling System (IGMS),” *Power Systems Computation Conference (PSCC)*, Genoa, Italy, 2016. [[IEEEExplore](#)]
- (C5) F. Ding, B. Mather, N. Ainsworth, P. Gotseff, and **K. Baker**, “Locational Sensitivity Investigation on PV Hosting Capacity and Fast Track PV Screening,” *IEEE PES T&D*, Dallas, TX, USA, 2016 [[IEEEExplore](#)].
- (C4) **K. Baker**, G. Hug, and X. Li, “Optimal Storage Sizing using Two-Stage Stochastic Optimization for Intra-Hourly Dispatch,” *IEEE North American Power Symposium*, Pullman, WA, 2014 [[IEEEExplore](#)].
- (C3) **K. Baker**, D. Zhu, G. Hug, and X. Li, “Jacobian Singularities in Optimal Power Flow Problems Caused by Intertemporal Constraints,” *IEEE North American Power Symposium*, Manhattan, Kansas, USA, 2013 [[IEEEExplore](#)].
- (C2) **K. Baker**, G. Hug, and X. Li, “Inclusion of Inter-Temporal Constraints into a Distributed Newton-Raphson Method,” *IEEE North American Power Symposium*, Urbana-Champaign, USA, 2012 [[IEEEExplore](#)].
- (C1) **K. Baker**, G. Hug, and X. Li, “Optimal Integration of Intermittent Energy Sources Using Distributed Multi-step Optimization,” *IEEE Power and Energy Society General Meeting*, San Diego, USA, 2012 [[IEEEExplore](#)].

Technical Reports

(TR3) *On the Path to SunShot: Emerging Issues and Challenges in Integrating Solar with the Distribution System*, Technical Report NREL/TP-5D00-6533, B. Palmintier, R. Broderick, B. Mather, M. Coddington, **K. Baker**, F. Ding, M. Reno, M. Lave, and A. Bharatkumar, National Renewable Energy Laboratory, May 2016 [[Online](#)].

(TR2) *Integrated Distribution-Transmission Analysis for Very High Penetration Solar PV*, Technical Report NREL/TP-5D00-65550, B. Palmintier, E. Hale, T. Hansen, W. Jones, D. Biagioni, **K. Baker**, H. Wu, J. Giraldez, H. Sorensen, M. Lunacek, N. Merket, J. Jorgenson, B-M. Hodge, National Renewable Energy Laboratory, Jan. 2016 [[Online](#)].

(TR1) *Model Predictive Control of a Steam Turbine*, **K. Baker** and T.S. Leong, 2009.

Data Management

Public Dataset. Baker, Kyri et al. (2016): *Grid Connected Functionality*. National Renewable Energy Laboratory. [[Online](#)]

Teaching / Mentoring Experience

Mentor - Emma Raszmann (University of Pittsburgh), “Mathematical Model of Lithium-Ion Battery Behavior for Predictive Control of Residential Loads,” Summer 2016.

Teaching Assistant and Recitation Leader - *Optimization of Energy Networks* Fall 2011, Spring 2013.

Wrote assignments and exams, wrote and delivered recitation lectures, held weekly office hours, mentored groups of students on semester projects of their choice (distributed power flow, model predictive control of storage, energy efficient building control, etc).

Volunteer - *Andrew Carnegie Society (ACS)* April 2014.
Demonstrated CMU Energy Club’s solar cooker at the Andrew Carnegie Society (ACS) Environment and Energy Showcase to families and members of the community.

Volunteer - *Summer Engineering Experience for Girls (SEE)* Summer 2011, 2013-14.
Helped develop an instruction guide for middle school girls and assisted them in building and testing miniature wind generators.

Volunteer - *SWE High School Days @ CMU* Fall 2011.
Mentored students as they learned how to read schematics and construct circuits.

Professional Activities

Faculty Advisor , IEEE, University of Colorado Boulder Chapter	2017 - Present
Technical Advisor , The Alt-E Fund	2017 - Present
Member , Women in ECE (WinECE), Carnegie Mellon University,	2007 - 2014
Vice President , CMU Energy Club, Carnegie Mellon University,	2012
Member , Institute of Electrical and Electronic Engineers (IEEE),	2015 - Present
Webmaster , CMU Energy Club, Carnegie Mellon University	2013 - 2014
Member , Engineering Graduate Organization (EGO),	2010 - 2014.

Awards and Honors

Best Paper Award, Power and Energy Conference at Illinois (PECI),	2017
NREL Employee of the Month	Oct. 2016
NETL-RUA Student Travel Award	2014
Benjamin Garver Lamme/Westinghouse Graduate Fellowship	2010
Carnegie Institute of Technology Deans Tuition Fellowship	2010
Intel First Year Research Experience Award	2008

**Reviewing/
Organizing
Activities**

Panel Reviewer, National Science Foundation (NSF), 2015, 2016.

Technical Committee Member, SmartGridComm 2016

Session Chair, North American Power Symposium, 2016

Journal Reviewer, IEEE Transactions on Power Systems, IEEE Transactions on Smart Grid, IEEE Transactions on Automatic Control, IEEE Transactions on Sustainable Energy, IEEE Transactions on Parallel and Distributed Systems, IEEE Transactions on Energy Conversion, IEEE Transactions on Industrial Electronics, IEEE Systems Journal, IEEE Transactions on Control Systems Technology, IEEE Transactions on Industry Applications, IET Cyber-Physical Systems, Energies

Conference Reviewer, Conference on Decision and Control (CDC), ACM Transactions on Cyber-Physical Systems, North American Power Symposium (NAPS), IEEE SmartGridComm, Complex Networks, Power and Energy Conference at Illinois, IEEE Green Technologies Conference (GreenTech), International Federation of Automatic Control (IFAC)

**Previous
Research
Experience**

Carnegie Mellon University - Masters Researcher Mar. 2010 - May 2010.
Worked with a team of researchers performing long range iris recognition under low-lighting conditions, and facial detection and classification in YouTube videos.

Carnegie Mellon University - Student Researcher Sept. 2008 - Jun. 2009.
Assisted a professor in the modeling of stem cell growth. Developed a software program in Java for importing, parameter specification, and visualizing population growth of stem cells using mathematical models.

Boise State University - Undergraduate Researcher Jun. - Aug. 2008.
Wrote Verilog code for memory (SRAM) testing on FPGAs, worked with a class VI laser to characterize light sensitive materials, and monitored optical absorption of test structures using DC probe stations.

Intel Research - Undergraduate Researcher Feb. - May 2008.
Developed a stem cell labeling program in C++ for verifying tracking results.

**Industry
Experience**

Xerox Corporation - Imaging Intern Jun. - Aug. 2009.
Created a framework for automatic control of laser printer equipment in Labview easing the testing process for fellow engineers.

Hewlett-Packard - Software Intern Jun. - Aug. 2007.
I exercised my creativity with printer functionality testing in C# and Visual Basic.

Sapidyne Instruments - General Assistant Emphasizing in Information Technology
Mar. - Aug. 2005.
Setup and configuration of company's Linux backup server. Converted C++ application to Adobe Flash for interactive use on the company's website.

Invited Talks

IEEE Signal Processing Society Utah Chapter Invited Talk
University of Utah, Nov. 4, 2016.
Presentation: *Optimization Under Uncertainty in Power Systems*.

NREL Brownbag Series
National Renewable Energy Laboratory, July 11, 2016.
Presentation: *Data-Driven Chance Constraints for Optimal Power Flow*.

Oregon State Colloquium Series

Oregon State, Corvallis, OR, April 8, 2016.

Presentation: *Improving the Penetration of Renewable Energy: Transmission to Distribution.*

Carnegie Mellon Technical Talk

Carnegie Mellon University, Pittsburgh, PA, Sept. 9, 2015.

Presentation: *My Postdoctoral Experience at NREL.*

Valuation of Transactive Energy Systems Technical Meeting

Pacific Northwest National Laboratory, Richland, WA, July 7-8, 2015.

Presentation: *Integrated Energy Systems.*

CMU-SYSU Collaborative Innovation Research Center Technical Review

Carnegie Mellon University, Pittsburgh, PA, May 22, 2014.

Poster Presentation: *Optimal Sizing of Energy Storage and Fast Ramping Generation in the Electric Power System Under Uncertainties.*

Carnegie Mellon Electricity Conference

Carnegie Mellon University, Pittsburgh, PA, Feb. 4, 2014.

Poster Presentation: *Optimal Sizing and Placement of Energy Storage in a Power System.*

Carnegie Mellon Electricity Conference

Carnegie Mellon University, Pittsburgh, PA, Mar. 13, 2012.

Poster Presentation: *Optimal Integration of Intermittent Energy Sources Using Distributed Multi-Step Optimization.*

The First Annual Smart Grid Research Center Review

Carnegie Mellon University, Pittsburgh, PA, Sept. 27, 2011.

Poster Presentation: *Optimal Integration of Intermittent Energy Sources Using Distributed Model Predictive Control.*

Carnegie Mellon Electricity Conference

Carnegie Mellon University, Pittsburgh, PA, Mar. 8, 2011.

Poster Presentation: *Distributed Control for Electric Power Systems to Enable the Integration of Renewable Energy Sources.*

Intel Research Open House

Intel, Pittsburgh, PA, Oct. 28, 2008.

Poster Presentation: *Modeling Stem Cell Growth.*

Meeting of the Minds

Carnegie Mellon University, Pittsburgh, PA, May. 7, 2008.

Poster Presentation: *Stem Cell Tracking: Manual Verification.*