Duncan S. Callaway

Contact Information

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Education

Ph.D. Cornell University, Ithaca, New York, Theoretical and Applied Mechanics. Minor in Applied Mathematics. Thesis advisor: Steven Strogatz.
B.S. University of Rochester, Rochester, New York, Mechanical Engineering.

Research Interests

Demand response in buildings; large data problems in energy systems; grid integration of renewable electricity; control and economics of spatially distributed energy resources.

Positions

Visiting Professor, Power Systems Laboratory, Swiss Federal Institute of Technology Zürich (Spring 2018)
Associate Professor, Energy and Resources Group, University of California, Berkeley (2016-present)
Affiliated Faculty, Department of Electrical Engineering and Computer Science, University of California, Berkeley (2016-present)
Faculty Scientist, Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory (2010-present)
Affiliated Faculty, Department of Mechanical Engineering, University of California, Berkeley (2009-2016)
Assistant Professor, Energy and Resources Group, University of California, Berkeley (2009-2016)
Visiting Scholar, Department of Mechanical Engineering, University of California, Berkeley (Fall 2008)
Assistant Research Scientist, School of Natural Resources and Environment and Department of Mechanical Engineering (by courtesy), University of Michigan (2008-2009)
Research Investigator, School of Natural Resources and Environment and Department of Mechanical Engineering (by courtesy), University of Michigan (2006-2008)
Senior Design Engineer, PowerLight Corporation, Berkeley, CA (2005-2006)
Senior Engineer, Davis Energy Group, Davis, CA (2003-2005)

Fellowships & Awards

NSF Faculty Early Career Development (CAREER) Award
Hellman Faculty Fellow (UC Berkeley)
NSF Postdoctoral Fellow
NSF IGERT Fellow (Program focus: nonlinear systems)
NSF Predoctoral Fellow
General Motors Scholar (full tuition undergraduate academic scholarship)

Publications & Patents

Peer-Reviewed Journals,

55. Deshmukh, R., Wu, G., Phadke, A. and **Callaway, D.S.** "Opportunities and constraints for wind and solar resources in India: A techno-economic geospatial analysis," *(in preparation)*

54. Lee, Jonathan T. and **Callaway, D.S.**, "The cost of reliability in decentralized solar power systems in sub-Saharan Africa," *(in review)*

53. Liu, M., Peeters, S., **Callaway, D.S.**, Claessens, B.J. "Trajectory tracking with an aggregation of domestic hot water heaters: Combining model-based and model-free control in a commercial deployment," *(in review)*.

52. Castro, F.A. and **Callaway, D.S.**, "Optimal electricity tariff design with demand-side investments" (in review).

51. Tabone, M.D. and **Callaway, D.S.** "Disaggregating cooling energy use and learning indoor temperature schedules from AMI data." (in review).

50. Dobbe, R., Sondermeijer, O., Fridovich-Keil, D., Arnold, D.B., **Callaway, D.S.** and Tomlin, C.J., "Data-Driven Decentralized Optimal Power Flow" (in review).

49. Dobbe, R., van Westering, W., Liu, S.X., Arnold, D.B., **Callaway, D.S.** and Tomlin, C.J., "Forecasting-Based State Estimation for Three-Phase Distribution Systems with Limited Sensing" (in review).

48. Liu, M., Phanivong, P.K., Shi, Y. and **Callaway, D.S.**, "Decentralized Charging Control of Electric Vehicles in Residential Distribution Networks," *IEEE Transactions on Control Systems Technology* (2018). DOI: 10.1109/TCST.2017.2771307

47. Ponce de Leon, D., Suffian, S., Kammen, D.M. and **Callaway, D.S.**, "Opportunities for Behavioral Energy Efficiency and Flexible Demand in Data-Limited Low-Carbon Resource Constrained Environments," *Applied Energy* (2018), https://doi.org/10.1016/j.apenergy.2018.06.115

46. Kara, E.C., Roberts, C.M., Tabone, M.D., Alvarez, L., **Callaway, D.S.** and Stewart, E.M. "Disaggregating solar generation from feeder-level measurements," *Sustainable Energy, Grids and Networks* (2018). https://doi.org/10.1016/j.segan.201

45. Arnold, D.B., Sankur, M.D., Negrete-Pincetic, M. and **Callaway, D.S.**, "Model-Free Optimal Coordination of Distributed Energy Resources for Provisioning Transmission-Level Services," *IEEE Transactions on Power Systems* (2018). DOI: 10.1109/TPWRS.2017.2707405

44. Wu, G.C., Deshmukh, R., Ndhlukula, K., Radojicic, T., Reilly-Moman, J., Phadke, A., Kammen, D.M. and **Callaway, D.S.**, "Strategic siting and regional grid interconnections key to low-carbon futures in African countries," *Proceedings of the National Academy of Sciences*, (2017). https://doi.org/10.1073/pnas.1611

43. Wenzel, G., Negrete-Pincetic, M., MacDonald, J. and **Callaway, D.S.**, "Real-time Scheduling of Electric Vehicles for Ancillary Services," IEEE Transactions on Smart Grid (2017). DOI: 10.1109/TSG.2017.2681961

42. **Callaway, D.S.**, Fowlie, M.L. and McCormick, G., "Location, location, location: The variable value of renewable energy and demand-side efficiency resources," Journal of the Association of Environmental and Resource Economists (2017). https://doi.org/10.1086/694179.

41. Tabone, M. ,Goebel, C., and **Callaway, D.S.**, "The effect of PV siting on power system flexibility needs," *Solar Energy* (2016). https://doi.org/10.1016/j.solener.2016.

40. Vrettos, E., Kara, E.C., MacDonald, J. S., Andersson, G. and **Callaway, D.S.** "Experimental Demonstration of Frequency Regulation by Commercial Buildings Part I: Modeling and Hierarchical Control Design," IEEE Transactions on Smart Grid (2016). DOI: 10.1109/TSG.2016.2628897

39. Vrettos, E., Kara, E.C., MacDonald, J. S., Andersson, G. and **Callaway, D.S.** "Experimental Demonstration of Frequency Regulation by Commercial Buildings Part II: Results and Performance Evaluation," IEEE Transactions on Smart Grid (2016). DOI: 10.1109/TSG.2016.2628893

38. Cohen, M.A., Niemeyer, G., and **Callaway, D.S.**, "Griddle: Video Gaming for Power System Education," *IEEE Transactions on Power Systems* (2016). DOI: 10.1109/TPWRS.2016.2618887.

37. Yang, I., **Callaway, D.S.**, and Tomlin, C.J., "Variance-Constrained Risk Sharing in Stochastic Systems," *IEEE Transactions on Automatic Control* (2017). DOI: 10.1109/TAC.2016.2599581

36. Taylor, J.A. and Dhople, S.V. and **Callaway, D.S.**, "Power Systems without Fuel," *Renewable and Sustainable Energy Reviews* 57, pp 1322-1336 (2016).

    https://doi.org/10.1016/j.rser.2015.12.083

35. Taylor, J.A. and Mathieu, J.L and **Callaway, D.S.** and Poolla, K., "Price and capacity competition in energy storage and demand response markets," *Energy Systems* (2017).

    https://doi.org/10.1007/s12667-016-0193-9

34. Solomon, A.A. and Kammen, D.M. and **Callaway, D.S.**, "Investigating the impact of wind-solar complementarities on energy storage requirement and the corresponding supply reliability criteria," *Applied Energy*, pp 130-145 (2016). https://doi.org/10.1016/j.apenergy.2016.01.070

33. Sanchez, D.L. and **Callaway, D.S.**, "Optimal Scale of Carbon-Negative Energy Facilities" *Applied Energy* 170, pp 437-444 (2016). https://doi.org/10.1016/j.apenergy.2016.0

32. Arnold, D.B., Negrete-Pincetic, M., Auslander D.M., and **Callaway, D.S.**, "Model-Free Optimal Control of VAR Resources in Distribution Systems: An Extremum Seeking Approach" *IEEE Transactions on Power Systems* (2016).

31. Xu, Z., **Callaway, D.S.**, Hu, Z. and Song, Y. "Real-time Scheduling of Generalized Flexible Loads" *IEEE Transactions on Power Systems* Vol. 31, No. 6, pp 4206-4216 (2016).

30. Cohen, M.A. and **Callaway, D.S.**, "Effects of Distributed PV Generation on Californias Distribution System, Part 1: Engineering Simulations," *Solar Energy* (2016).

29. Cohen, M.A. and Kauzmann P.A. and **Callaway, D.S.**, "Effects of Distributed PV Generation on Californias Distribution System, Part 2: Economic Analysis," *Solar Energy* (2016).

28. Ponce de Leon, D and Johnston, J. and Moncada, M.V. and **Callaway, D.S.** and Kammen, D.M., "Evidence and Future Scenarios of a Low-Carbon Energy Transition in Central America," *Environmental Research Letters* (2015)

27. Tabone, M. and **Callaway, D.S.**, "Modeling distributed photovoltaic production: A hidden state, spatio-temporal approach," *IEEE Transactions on Power Systems* (2015).

26. Addy, N., Kiliccote, S., **Callaway, D.S.** and Mathieu, J.L. "How Baseline Model Implementation Choices Affect Demand Response Assessments" *Journal of Solar Energy Engineering - Including Wind Energy and Building Energy Conservation* vol 137.2 (2015).

25. Mathieu, J.L , Dyson, M.E , **Callaway, D.S**. "Resource and revenue potential of California residential load participation in ancillary services," *Energy Policy* 80, pp. 76-87 (2015).

24. Raichur, V., **Callaway D.S.**, and Skerlos S.J., "Estimating Emissions from Electricity Generation Using Electricity Dispatch Models: The Importance of System Operating Constraints," *Journal of Industrial Ecology*, (2015).

23. Mathieu, J.L. and Kamgarpour, M. and Lygeros, J. and Andersson, G. and **Callaway, D.S.**, "Arbitraging Intraday Wholesale Energy Market Prices with Aggregations of Thermostatic Loads," *IEEE Transactions on Power Systems*, (2015).

22. Solomon, A.A. and Kammen, D.M. and **Callaway, D.S.**, "The role of large-scale energy storage design and dispatch in the power grid: A study of very high grid penetration of variable renewable resources," *Applied Energy*, DOI: 10.1016/j.apenergy.2014.07.095 (2014).

21. Dyson, M.E. and Borgeson S. and Tabone, M. and **Callaway, D.S.**, "Using smart meter data to estimate demand response potential, with application to solar energy integration," *Energy Policy*, DOI: 10.1016/j.enpol.2014.05.053 (2014).

20. Goebel, C and **Callaway D.S.**, and Jacobsen, H.A. "The Impact of State of Charge Management when Providing Regulation Power with Energy Storage," *IEEE Power Engineering Letters* (2014).

19. Taylor, J.A., Nayyar, A., **Callaway D.S.** and Poolla, K. "Consolidated Dynamic Pricing of Power System Regulation," *IEEE Transactions on Power Systems* (2013).

18. Subramanian, A., Garcia, A.M., **Callaway, D.S.**, Poolla, K.P, Varaiya, P. "Real-time Scheduling of Distributed Resources," *IEEE Transactions on Smart Grid* (2013).

17. Goebel, C and **Callaway D.S.**, "Using ICT-Controlled Plug-in Electric Vehicles to Supply Grid Regulation in California at Different Renewable Integration Levels," *IEEE Transactions on Smart Grid* (2013).

16. Taylor, J.A., **Callaway D.S.** and Poolla, K. "Competitive energy storage in the presence of renewables," *IEEE Transactions on Power Systems* (2013).

15. Mathieu, J.L., Koch, S and **Callaway D.S.** "State Estimation and Control of Electric Loads to Manage Real-Time Energy Imbalance," *IEEE Transactions on Power Systems* (2013).

14. Ma, Zhongjing, **Callaway, D.S.** and Hiskens I.A. "Decentralized Charging Control of Large Populations of Plug-in Electric Vehicles," *IEEE Transactions on Control Systems Technology* (2013).

13. Mathieu, J.L., **Callaway, D.S.** and Kiliccote, S. "Variability in Automated Responses of Commercial Buildings and Industrial Facilities to Dynamic Electricity Prices," *Energy and Buildings,* Volume 43, Issue 12, Pages 3322-3330 (2011).

12. Moura, S.J., Fathy, H.K., **Callaway, D.S.**, Stein, J.L. **"**A Stochastic Optimal Control Approach for Power Management in Plug-in Hybrid Electric Vehicles," *IEEE Transactions on Control Systems Technology*, 19(3): 545-555, (2011)

11. **Callaway, D.S.** and Hiskens, I. A., "Achieving Controllability of Electric Loads," *Proceedings of the IEEE,* Volume 99, Number 1, pp 184 - 199, (2011).

10. **Callaway, D.S.** "Sequential reliability forecasting for wind energy: Temperature dependence and probability distributions," *IEEE Transactions on Energy Conversion,* Volume 25, Issue 2, pp 577-587 (2010).

9. Moura, S.J., **Callaway, D.S.**, Fathy, H.K., Stein, J.L. **"**Tradeoffs between Battery Energy Capacity and Stochastic Optimal Power Management in Plug-in Hybrid Electric Vehicles," *Journal of Power Sources,* Volume 195, Issue 9, Pages 2979-2988 (2010).

8. **Callaway D.S.** "Tapping the energy storage potential in electric loads to deliver load following and regulation, with application to wind energy," *Energy Conversion and Management*, 50, 1389-1400 (2009).

7. **Callaway D.S.**, Hastings A. "Consumer movement through differentially subsidized habitats creates a spatial food web with unexpected results," *Ecology Letters*, 5 (3): 329-332 (2002).

6. Girvan M., **Callaway D.S.**, Newman M.E.J., Strogatz S.H. "Simple model of epidemics with pathogen mutation" *Physical Review E*, 65 (3): Art. No. 031915 Part 1 (2002).

5. **Callaway D.S.**, Perelson A.S. "HIV-1 infection and low steady state viral loads" *Bulletin of Mathematical Biology*, 64 (1): 29-64 (2002).

4. **Callaway D.S.**, Hopcroft J.E., Kleinberg J.M., Newman M.E.J., Strogatz S.H. "Are randomly grown graphs really random?" *Physical Review E*, 64 (4): Art. No. 041902 Part 1 Oct (2001).

3. **Callaway D.S.**, Newman M.E.J., Strogatz S.H., Watts D.J. "Network robustness and fragility: Percolation on random graphs." *Physical Review Letters*, 85 (25): 5468-5471 Dec 18 (2000).

2. **Callaway D.S.**, Ribeiro R.M., Nowak M.A. "Virus phenotype switching and disease progression in HIV-1 infection," *Proceedings of the Royal Society of London Series B-Biological Sciences* 266 (1437): 2523-2530 Dec 22 (1999).

1. Furtado M.R., **Callaway D.S.**, Phair J.P., Kunstman K.J., Stanton J.L., Macken C.A., Perelson A.S., Wolinsky S.M. "Persistence of HIV-1 transcription in peripheral-blood mononuclear cells in patients receiving potent antiretroviral therapy," *New England Journal of Medicine* 340 (21): 1614-1622 May 27 (1999).

Book Chapters

1. Ma, Z, **Callaway, D.S.** and Hiskens, "Optimal Charging Control for Plug-In Electric Vehicles," in: *Control and Optimization Methods for Electric Smart Grids*, A. Chakrabortty and M.D. Ilic (editors), Springer, 2012.

Other Technical Reports and Conference Proceedings:

9. Deshmukh, R., **Callaway, D.S.**, Abhyankar, N. and Phadke, A. "Cost and Value of Wind and Solar in Indias Electric System in 2030," First International Conference on Large Scale Grid Integration of Renewable Energy India (2017).

8. Yang, I., **Callaway, D.S.**, and Tomlin, C., "Risk-Limiting Dynamic Contracts for Direct Load Control," Proceedings of Allerton Conference on Communication, Control, and Computing, Monticello, IL, (2014).

7. Anuradha M. Annaswamy (lead), Jacob Aho, Massoud Amin, George Arnold, Andrew Buckspan, Angela Cadena, **Duncan Callaway**, Eduardo Camacho, Michael Caramanis, Aranya Chakrabortty, Amit Chakraborty, Joe Chow, Munther Dahleh, Christopher L. DeMarco, Alejandro Dominguez-Garcia, Daniel Dotta, Amro Farid, Paul Flikkema, Dennice Gayme, Sahika Genc, Merce Griera i Fisa, Ian Hiskens, Paul Houpt, Gabriela Hug, Pramod Khargonekar, Himanshu Khurana, Arman Kiani, Steven Low, John McDonald, Eduardo Mojica-Nava, Alexis Legbedji Motto, Lucy Pao, Alessandra Parisio, Adrian Pinder, Michael Polis, Mardavij Roozbehani, Zhihua Qu, Nicanor Quijano, Tariq Samad, Jakob Stoustrup, "IEEE Vision for Smart Grid Controls: 2030 and Beyond," (2014)

6. **Callaway, D.S.**, and Mathieu, J.L., and Dyson, M.E., and Kamgarpour, Maryam, and Koch, Stephan and Lygeros, John, "Mitigating Renewables Intermittency Through Nondisruptive Load Control ," Power Systems Engineering Research Center Technical Report (2013)

5. Taylor, J.A., Mathieu, J.L., **Callaway, D.S.**, and Poolla, K., "Price and capacity competition in storage and zero-mean energy markets," to appear in the Proceedings of Allerton Conference on Communication, Control, and Computing, Monticello, IL (2012).

4. S. Oren, **D. Callaway**, J.L. Mathieu, A. Papavasilou, T. Mount, M. Zhang, R. Thomas, G. Gross, A. Dominguez-Garcia, 2012. "Renewable Energy Integration and the Impact of Carbon Regulation on the Electric Grid." PSERC Future Grid Initiative White Paper, Part 3.

3. Mathieu, J.L. and **Callaway, D.S.**, "The Value of Real-Time Data in Controlling Electric Loads for Demand Response." Submitted as a supplement to an invited presentation at the Carnegie Mellon Conference on the Electricity Industry, 13-14 Mar 2012.

2. **Callaway, D.S**. Fueling the Biodiesel Debate. *Solar Today,* Jan/Feb 2006

1. **Callaway, D.S**. Solving the Biodiesel Equation. *Solar Today,* p. 32. Nov/Dec 2005

Peer-Reviewed Conference Proceedings

42. Hidalgo-Gonzalez, P., Dobbe, R. Henriquez-Auba, R., **Callaway, D.S.** and Tomlin, C.J. "Frequency Regulation in Hybrid Power Dynamics with Variable and Low Inertia due to Renewable Energy," 2018 IEEE Conference on Decision and Control (to appear).

41. Henriquez-Auba, R., Pauli, R., Kalathil, D, **Callaway, D.S.** and Kameshwar Poolla, "The Sharing Economy for Residential Solar Generation," 2018 IEEE Conference on Decision and Control (to appear).

40. Noah Klugman, Veronica Jacome, Meghan Clark, Matthew Podolsky, Patrick Pannuto, Neal Jackson, Aley Soud Nassor, Catherine Wolfram, **Duncan Callaway**, Jay Taneja, Prabal Dutta, "Experience: Android Resists Liberation from Its Primary Use Case," The 24th Annual International Conference on Mobile Computing and Networking, 2018 (to appear).

39. Avila, N., **Callaway, D.S.** and Kammen, D.M., "Generation expansion analysis in low data settings", PowerAfrica 2018 (to appear)

38. Sunter, D.A., Dees, J., Castellanos, S, **Callaway, D.S.**, and Kammen, D.M. "Political Affiliation and Rooftop Solar Adoption in New York and Texas," 2018 IEEE 45th Photovoltaic Specialists Conference (to appear).

37. Liu, M., Phanivong, P. and **Callaway, D.S.**, "Customer- and Network-Aware Decentralized EV Charging Control," 20th Power Systems Computation Conference (to appear).

36. Liu, M., Phanivong, P.K., and **Callaway, D.S.** "Electric vehicle charging control in residential distribution network: A decentralized event-driven realization," IEEE 56th Annual Conference on Decision and Control, 214-219 (2017)

35. Dobbe, R., Arnold, D., Liu, S. **Callaway, D.S.** and Claire Tomlin, "Real-Time Distribution Grid State Estimation with Limited Sensors and Load Forecasting," 2016 ACM/IEEE 7th International Conference on Cyber-Physical Systems.

34. Juul, F., Negrete-Pincetic, M., MacDonald, J. and **Callaway, D.S.**, "Real-time Scheduling of Electric Vehicles for Ancillary Services" Proceedings of the IEEE Power and Energy Society General Meeting, (2015).

33. Arnold, D.B., Negrete-Pincetic, M., Stewart, E., Auslander, D.M. and **Callaway, D.S.**, "Extremum Seeking Control of Smart Inverters for VAR Compensation," Proceedings of the IEEE Power and Energy Society General Meeting, (2015).

32. Yang, I. and **Callaway, D.S.** and Tomlin, C.J. "Indirect Load Control for Financial Risk Management in Electricity Markets via Risk-Limiting Dynamic Contracts," Proceedings of 2015 American Control Conference (ACC), Chicago, IL (2015).

31. Kara, E.C., Tabone, M.D., MacDonald, J.S., **Callaway, D.S.**, and Kiliccote, S., "Quantifying flexibility of residential thermostatically controlled loads for demand response: a data-driven approach," Proceedings of the 1st ACM Conference on Embedded Systems for Energy-Efficient Buildings (2014).

30. Maasoumy, M., Rosenberg, C. and Sangiovanni-Vincentelli, A. and **Callaway, D.S.**, "Model Predictive Control Approach to Online Computation of Demand-Side Flexibility of Commercial Buildings HVAC System for Supply Following," 2014 American Control Conference.

29. Yang, I. and **Callaway, D.S.** and Tomlin, C.J., "Dynamic Contracts with Partial Observations," 2014 American Control Conference.

28. Addy, N., Mathieu, J.L., Kiliccote, S., and **Callaway, D.S.** "Understanding the Effect of Baseline Modeling Implementation Choices on Analysis of Demand Response Performance", Proceedings fo the ASME 2013 International Mechanical Engineering Congress & Exposition (2013).

27. Cohen, M.A. and **Callaway, D.S.**, "Modeling the Effect of Geographically Diverse PV Generation on California's Distribution System," IEEE International Conference on Smart Grid Communications (2013).

26. Kamgarpour, M. and Ellen, C. and Soudjani, S. and Gerwinn, S. and Mathieu, J.L. and Müllner, N. and Abate, A. and **Callaway, D.S.** and Fränzle, M and Lygeros, J., "Modeling Options for Demand Side Participation of Thermostatically Controlled Loads," IREP Symposium-Bulk Power System Dynamics and Control, Rethymnon, Greece (2013).

25. Tabone, M.D. and **Callaway, D.S.** "Parameterizing Fluctuations in Solar Photovoltaic Generation Using Hidden Markov Models," Proceedings of the IEEE Power and Energy Society General Meeting, Vancouver Canada (2013).

24. Mathieu, J.L. and Kamgarpour, M. and Lygeros, J. and **Callaway, D.S.**, "Energy Arbitrage with Thermostatically Controlled Loads," Proceedings of the European Control Conference, Zürich, Switzerland (2013).

23. Taylor, J.A. and Nayyar, A. and **Callaway, D.S.** and Poolla, K., "Dynamic Pricing in Consolidated Ancillary Service Markets," Proceedings of the European Control Conference, Zürich, Switzerland (2013).

22. MacDonald, J. and Cappers, P and **Callaway, D.S.** and Kiliccote, S. "Demand Response Providing Ancillary Services: A Comparison of Opportunities and Challenges in the US Wholesale Markets" Proceedings of the GridInterop Forum, 11 pages (2012)

21. Subramanian, A. and Taylor, J.A. and Bitar, E. and **Callaway, D.S.** and Poolla, K. and Varaiya, P. "Optimal power and reserve capacity procurement policies with deferrable loads," IEEE 51st Annual Conference on Decision and Control, (2012).

20. Mathieu, J.L , Dyson, M.E , **Callaway, D.S**. "Using Residential Electric Loads for Fast Demand Response: The Potential Resource and Revenues, the Costs, and Policy Recommendations," ACEEE Summer Study on Energy Efficiency in Buildings (2012).

19. Taylor, J.A., **Callaway, D.S.**, Poolla, K., "Inventory control of storage in distribution systems," Proceedings of the American Control Conference (2012).

18. Subramanian, A., Garcia, A.M., Dominguez-Garcia, A., **Callaway, D.S.**, Poolla, K.P, Varaiya, P. "Real-time Scheduling of Deferrable Electric Loads" Proceedings of the American Control Conference (2012).

17. Mathieu, J.L. and **Callaway, D.S. "**State Estimation and Control of Heterogeneous Thermostatically Controlled Loads for Load Following," *Proceedings of the 45th Hawaii International Conference on System Sciences,* Manoa Hawai'i (2012).

16. Mathieu, J.L. , **Callaway, D.S.** and Kiliccote, S. "Examining Uncertainty in Demand Response Baseline Models and Variability in Automated Responses to Dynamic Pricing," *Proceedings of the IEEE Conference on Decision and Control*, Orlando Florida (2011).

15. Alizadeh, M., Scaglione, A. ,Thomas R.J. and **Callaway, D.S.** "Information Infrastructure for Cellular Load Management in Green Power Delivery Systems," *Proc. IEEE SmartGridComm* (2011).

14. Ma, Z, **Callaway, D.S.** and Hiskens, I.A. , "Distributed MPC Methods in Charging Control of Large Populations of Plug-in Electric Vehicles," *Proceedings of the 18th IFAC World Congress*, (2011).

13. Koch, S. , Mathieu, J.L., and **Callaway, D.S. "**Modeling and Control of Aggregated Heterogeneous Thermostatically Controlled Loads for Ancillary Services," *Proceedings of the 17th Power Systems Computation Conference*, (2011).

12. Keep, T.M., Sifuentes, F.E., Auslander, D.M. and **Callaway D.S. "**Using load switches to control aggregated electricity demand for load following and regulation," *Proceedings of the IEEE Power & Energy Society General Meeting*, Detroit MI (2011).

11. **Callaway, D.S.** , "Can smaller loads be profitably engaged in power system services?" *Proceedings of the IEEE Power & Energy Society General Meeting*, Detroit MI (2011).

10. Ma, Z, **Callaway, D.S.** and Hiskens, I.A., "Decentralized Charging Control for Large Populations of Plug-in Electric Vehicles," *Proceedings of the IEEE Conference on Decision and Control*, Atlanta Georgia, (2010).

9. Ma, Zhongjing , **Callaway, D.S.** and Hiskens, I.A., "Decentralized Charging Control for Large Populations of Plug-in Electric Vehicles: Application of the Nash Certainty Equivalence Principle." *Proceedings of the 2010 IEEE Multi-Conference on Systems and Control* Yokohama, Japan, September 8-10, (2010).

8. Kashyap, A. and **Callaway, D.S.** , "Controlling distributed energy constrained resources for power system ancillary services," *Proceedings of the 11th International Conference for Probabilistic Methods Applied to Power Systems,* (2010).

7. Kashyap, A. and **Callaway, D.S.** , "Estimating the probability of load curtailment in power systems with responsive distributed storage," *Proceedings of the 11th International Conference for Probabilistic Methods Applied to Power Systems,* (2010).

6. Mathieu, J.L. , Gadgil, A.J., **Callaway, D.S.,** Price, P.N., Kiliccote, S. "Characterizing the Response of Commercial and Industrial Facilities to Dynamic Prices from the Utility" *Proceedings of ASME 2010 4th International Conference on Energy Sustainability* (2010).

5. Hiskens, I.A. and **Callaway, D.S.**, "Achieving Controllability of Plug-in Electric Vehicles," *5th International IEEE Vehicle Power and Propulsion Conference*, Dearborn, Michigan, September (2009).

4. Moura, S.J., Fathy, H.K., **Callaway**, **D.S.**, Stein, J.L., "A Stochastic Optimal Control Approach for Power Management in Plug-in Hybrid Electric Vehicles," *ASME 2008 Dynamic Systems and Control Conference,* Ann Arbor, Michigan, October 20-22, (2008).

3. Moura, S.J., **Callaway, D.S.**, Fathy, H.K., Stein, J.L. **"**Impact of Battery Sizing on Stochastic Optimal Power Management in Plug-in Hybrid Electric Vehicles," *2008 IEEE International Conference on Vehicular Electronics and Safety,* Columbus, Ohio, September 22-24, (2008).

2. Bourne D., **Callaway D.**, Dwiggins H., and Lee E. Durability Testing of a Low Cost ICS Solar Water Heater. *Solar 2004, Proceedings, 33rd American Solar Energy Society Annual Conference*, Portland, OR, American Solar Energy Society, (2004).

1. Bourne D., **Callaway D.**, Lee E. and Plaisted J., Design and Development of a Low Cost ICS Solar Water Heater, *Solar 2003, Proceedings, 32nd American Solar Energy Society Annual Conference*, Austin, TX, American Solar Energy Society, (2003).

Patents:

2. Bourne R.C., Lee B.E., **Callaway D.S**. Vertical counterflow evaporative cooler. U.S. Patent Number 6,845,629, January 25, 2005

1. Bourne R.C., Lee B.E., **Callaway D.S**. Two stage indirect evaporative cooling system. US Patent Number 6,931,883, August 23, 2005

Invited talks

Zanzibar Electric Corporation, "Reliability in Unjuga" July 12, 2018.

Power Systems Laboratory, ETH Zürich, "Decentralization in Energy Systems: Absorbing Solar and Storage into Grids." May 16, 2018.

Oxford University Control Group, "Model free control and optimization in electric distribution systems." April 30, 2018.

UC Louvain (Belgium), "Model free control and optimization in electric distribution systems." March 20 2018.

Institute for Automation, ETH Zürich, "Model free control and optimization in electric distribution systems." March 8 2018.

Western Interstate Energy Board, "Locational Value of Distributed Solar: Engineering and Economic Considerations", October 26 2017.

National Resources Defense Council San Francisco office, "Electrifying Loads in California," June 19, 2017.

More than Smart Initiative, Oakland. "Electrifying Loads in California," June 19, 2017.

MIT Laboratory for Information and Decision Systems, "Distributed Energy Resource Control and Network Optimization," February 28, 2017.

MIT Energy Initiative Grad Lunch "Quantifying and Mitigating the Impacts of PV in Distribution Systems," February 28, 2017.

KU Leuven (Belgium) – Energyville, "Distributed Energy Resource Control and Network Optimization," December 7, 2016.

Pontificia Universidad Catolica de Chile, Santiago, "Distributed Energy Resource Control and Network Optimization," November 21, 2016.

Princeton University, Vincent Poor Research Group, "Integrating Distributed Solar into Electric Power Systems," November 18, 2015.

Stanford Energy Resources Engineering, "Integrating Distributed Solar into Electric Power Systems," October 12, 2015.

UC Berkeley Electrical Engineering and Computer Science, "Integrating Distributed Solar into Electric Power Systems," October 8, 2015.

California Energy Commission, "Resource and Revenue Potential of California Residential Load Participation in Ancillary Services," at the IEPR Commissioner Workshop on the State of the Science on Scenarios to Deeply Reduce Greenhouse Gas Emissions from Californias Energy System, July 24, 2015.

UC San Diego Mechanical and Aerospace Engineering, "Forecasting the reserve requirements of power systems with high PV penetrations: does PV plant location matter?" May 13, 2015.

Los Alamos National Lab Grid Science Winter School, "Stochastic Models of Load and Renewables," January 14, 2015.

Keynote speaker at SinBerBEST Annual Symposium, National University of Singapore, "Coupling building systems with electric power system operations," January 6, 2015.

Cornell Center for Applied Math, "Models, Contracts and Control That Help Electricity Consumers to Help the Grid," November 21, 2014.

Power Systems Engineering Research Center public webinar, "Quantifying and Mitigating the Impacts of PV in Distribution Systems," November 18, 2014.

2014 Allerton Conference, "Risk-Limiting Dynamic Contracts for Direct Load Control," October 1, 2014

2014 IEEE PES General Meeting "Demand Response for Ancillary Services." July 28, 2014.

State of California Assembly Staff Seminar Series, "Physical and Economic Effects of Distributed PV Generation on Californias Distribution System," (with student Michael Cohen), May 9, 2014.

Humboldt State University Schatz Energy Research Center, "Leveraging large data sets and control to enable low carbon power systems," April 10, 2014.

2014 EI@Haas POWER Conference, "Physical and Economic Effects of Distributed PV Generation on Californias Distribution System," (with student Michael Cohen), March 21, 2014.

2014 Information Theory and Applications Workshop, "Leveraging large data sets and control to enable low carbon power systems," February 13, 2014.

Columbia University Mechanical Engineering, "Leveraging large data sets and control to enable low carbon power systems," December 6, 2013.

Carnegie Mellon University Electrical and Computer Engineering, "Leveraging large data sets and control to enable low carbon power systems," December 4, 2013.

University of Texas at Austin Energy Symposium, "Leveraging large data sets: demand side models and control in low carbon power systems," November 7, 2013.

Texas A&M Electrical and Computer Engineering, "Quantifying and managing the impacts of large scale solar electricity generation," September 11, 2013.

Semi-plenary speaker on Energy Systems, European Control Conference, "Demand-side modeling, estimation and control in electric power systems," July 18, 2013.

European Control Conference Tutorial Session on Control in Electric Power Systems, "Demand Response for Enhanced Control of Electric Power Systems." July 18, 2013.

Stanford Atmosphere and Energy Seminar Series, "Large-scale penetration of photovoltaics: impacts distribution systems and ancillary services," May 21, 2013.

University of Michigan Electrical and Computer Engineering, "Large-scale penetration of photovoltaics: impacts distribution systems and ancillary services," May 3, 2013.

University of California, Los Angeles Smart Energy Research Center, "Responsive Load and Distributed Storage," Training workshop, March 19, 2013

Energy and Environmental Economics, Inc, "Quantifying and lowering the cost of fast demand response resources for renewables integration," Lunch Seminar, Nov 2, 2013.

Carnegie Mellon University Electrical and Computer Engineering Department, "Quantifying and lowering the cost of fast demand response resources for renewables integration," October 5, 2012.

Arizona State University Electrical, Computer and Energy Engineering Department, "Quantifying and lowering the cost of fast demand response resources for renewables integration" August 24, 2012.

American Control Conference Workshop on Green Buildings (Montreal), "Building-to-Grid Fundamentals," June 26, 2012.

32nd Center for Nonlinear Studies Annual Conference (Los Alamos), "Distributed coordination for demand response," May 24, 2012.

UC Berkeley Center for Built Environment Industry Advisory Board Conference, "Feedback control in grid responsive buildings," April 12, 2012.

Massachusetts Institute of Technology, Laboratory for Information and Decision Systems Special Seminar, "Distributed computation in complex energy networks" April 12, 2012.

University of Illinois at Urbana Champaign, ECE Colloquium, "Mining for demand response resources: lowering extraction costs and examining the resource potential for non-disruptive load control" February 23, 2012.

ETH Zürich, EEH Colloquium, "Aggregation models and feedback control for demand side flexibility in power systems" November 29, 2011.

Forty-Ninth Annual Allerton Conference on Communication, Control, and Computing, "Decentralized electric vehicle charge coordination with constrained communications," September 29, 2011.

American Control Conference Workshop on Control, Modeling and Optimization Challenges in the Smart Grid (San Francisco), "Responsive Load and Distributed Storage," June 28, 2011.

SIAM Conference on Dynamical Systems (Snowbird, Utah), "Engaging the Demand Side in Renewables Integration," May 25, 2011.

Connectivity Week Conference (San Jose CA), "Addressing Fast DR Metering and Control Challenges," May 23, 2011.

Beijing Institute of Technology, School of Automation, "The Role of the Demand Side in Renewables Integration," March 4, 2011.

National Science Foundation Pre-conference on Dynamical Systems: New Directions in Dynamical Systems, "Dynamics, Electric Power, and the Smart Grid," January 4, 2011.

UC Berkeley, i4energy Seminar Series, "The Role of Demand Response in Renewables Integration" November 12, 2010.

National Academy of Engineering German-American Frontiers of Engineering Symposium, "Coupling systems with electric vehicles for sustainability, security and grid reliability," April 23-25 2010.

Los Alamos National Laboratory, Center for Nonlinear Studies, "Aggregated Electricity Load Modeling & Control for Fast Ancillary Services" April 6, 2010.

Power Systems Engineering Research Center public webinar, "Aggregated Electricity Load Modeling & Control for Regulation and Load Following Ancillary Services." November 3 2009.

20th International Symposium on Mathematical Programming "Aggregated Electricity Load Modeling & Control for Regulation and Load Following Ancillary Services" August 26, 2009.

University of California, Berkeley Energy and Resources Group Colloquium, "Examining energy storage and its alternatives in sustainable energy systems." February 11 2009.

Group for Research in Decision Analysis (GERAD, a multi-university research center), Montreal. "Statistical mechanical representations of distributed energy storage devices to facilitate sustainable energy production," January 16, 2009.

Western Electricity Coordinating Council, Modeling Coincident Energies to produce Coincident Dispatch Seminar, "Wind Forecasting for System Reliability and Emissions Reduction from Wind Energy," November 6, 2008.

University of California, Berkeley: Renewable and Appropriate Energy Laboratory, Energy and Resources Group, "Greenhouse Gas Emissions Reductions from Wind Energy: Location, Location, Location?" October 29, 2008.

University of California, Berkeley: Berkeley Manufacturing Institute, Department of Mechanical Engineering, "Tapping the energy storage potential in electric loads with PCTs" September 22, 2008.

University of Michigan, CARSS / MMPEI Workshop on Energy and Social Science: Challenges and Opportunities, "Greenhouse Gas Emissions Reductions and Wind Energy Deployment" May 6, 2008.

University of Michigan Systems Science Seminar, "Reliability and Storage in Sustainable Energy Systems," February 2, 2008.

Cornell University Sibley School of Mechanical and Aerospace Engineering, "Engineering Sustainable Energy Systems," February 21, 2006.

University of Wisconsin, Madison: Energy Institute, "Engineering Sustainable Energy Systems," February 20 2006.

University of California, Davis, Dept of Mechanical and Aeronautical Engineering, "Engineering Sustainable Energy Systems," February, 2006.

Building Industry Research Alliance Annual Review, "Cutting Edge Heating and Cooling: OASys & NightBreeze," July 28, 2005.

Sacramento Municipal Utilities District Innovative Speaker Series, "Market Rate Zero Energy Homes." May, 2005.

Canadian Net Zero Energy Home Coalition Workshop. "Market Rate Zero Energy Homes" January 19th, 2005.

SIAM Conference on Dynamical Systems, "Random growing graphs." May 20-25, 2001

Princeton University: Levin-Pacala Labtea, "A simple epidemic model," June 18, 2000.

7th Annual International Discussion Meeting on HIV Dynamics and Evolution, "Intermittent viremia in HIV infection," April 30, 2000

Nonlinear Sciences Informal Seminar, Cornell University. "HIV phenotype switching." October 18, 2000.

Mathematical Biology Group Seminar, Department of Zoology, Oxford University, "HIV phenotype switching." October, 1998.

Mathematical Association of America, Seaway Section semi-annual meeting, "Mathematics in medicine." April, 1999

Student / Postdoc Supervision

Former Postdocs:

Mingxi Liu (University of Victoria ME PhD). 2016-2018, now Assistant Professor of Electrical and Computer Engineering, University of Utah.

Matias Negrete-Pincetic (UIUC EECS PhD). 2012-2014, now Assistant Professor of Electrical Engineering, Pontifical Catholic University of Chile.

Joshua Taylor (MIT ME PhD). 2011-2012, now Associate Professor, Electrical and Computer Engineering, University of Toronto

Zhongjing Ma (McGill ECE Ph.D), 2009-2010, now Associate Professor, Department of Automation, Beijing Institute of Technology

Current Ph.D.

Anna Brockway (Berkeley ERG)
Jonathan Lee (Berkeley ERG)
Phillippe Phanivong (Berkeley ERG)
Ciaran Roberts (Berkeley EECS)
Froy Sifuentes (Berkeley ERG)

Former Ph.D.:

Felipe Castro (Berkeley ERG, 2017), now Economist at Fiscala Nacional Econmica de Chile

Imran Sheikh (Berkeley ERG, 2017) now Assistant Professor at Western Washington University

Ranjit Deshmukh (Berkeley ERG, 2016), now Assistant Professor of Environmental Science, UC Santa Barbara

Michael Cohen (Berkeley ERG, 2016), now at Lead Developer at New Sun Road

Daniel Arnold (Berkeley ME; co-Chair with David Auslander, 2016), now Research Scientist, Lawrence Berkeley National Lab.

Michaelangelo Tabone (Berkeley ERG, 2016), now at Energy Algorithms Engineer at Nest.

Autumn Preskill (Berkeley ERG, 2015), Lead Software Developer at Transfix

Sam Borgeson (Berkeley ERG, 2014), now at Convergence Data Analytics.

Johanna Mathieu (Berkeley ME), graduated 2012, now Assistant Professor, University of Michigan ECE.

Richard Chen (Michigan IOE; co-chair with Amy Cohn) 2010. Now Operations Research Scientist at Sandia National Lab

Teaching

Michigan

NRE 580: Environmental Integrated Assessment (co-taught), Winter 2009

Berkeley

Buildings

Energy Efficiency Technology in Buildings, Fa2010, Sp2012.

Assessing Building Energy Use and Indoor Environmental Quality (co-taught with Stefano Schiavon, Architecture). Fa2013, Fa2014, Fa2015

Power systems

Electric Power Systems. Fa2009, Fa2011, Fa2012, Fa2013, Fa2014, Fa2015, Sp2017
Power Systems Engineering (co-taught with Kameshwar Poolla in Electrical Engineering). Fa2010.

Data

Statistical Learning Applied to Energy and Environmental Justice, Fa2017
Statistical Learning for Energy ad Environment, Fa2018

Other

Energy and Society, Fa2016
Energy Analysis Classics, Sp2012
Tools of the Trade, Fa2017
Second semester ERG Master's Seminar. Sp2012, Sp2014, Sp2015
Third Semester ERG Master's Seminar. Fa2011, Fa2013, Fa2014, Fa2015, Fa2016
Fourth Semester ERG Master's Seminar. Sp2014, Sp2015, Sp2016, Sp2017

Service

Journal referee: Applied Energy, Energy Conversion and Management, Energy Economics, Energy Policy, Environmental Research Letters, IEEE Systems Journal, IEEE Transactions on Control of Networked Systems, IEEE Transactions on Control Systems Technology, IEEE Transactions on Energy Conversion, IEEE Transactions on Power Electronics, IEEE Transactions on Power Systems, IEEE Transactions on Smart Grid, IEEE Transactions on Sustainable Energy, Nature Climate Change, Nature Energy, Physical Review E, Physical Review Letters, Physics Letters A, Proceedings of the National Academy of Sciences, Proceedings of the Royal Society of London Series B, Solar Energy, Utilities Policy

Conference referee: American Control Conference, Conference on Decision and Control, European Control Conference, Hawaii International Conference on Systems Science, IEEE Power and Energy Society General Meeting, IEEE SmartGridComm, IEEE Vehicle Power and Propulsion Conference, IFAC World Congress, Power Systems Computation Conference, PowerAfrica

Proposal referee: Cal Energy Corps, CITRIS Big Ideas, France-Berkeley Fund, Natural Sciences and Engineering Research Council of Canada, Power Systems Engineering Research Center, Research Grants Council of Hong Kong, Siebel Energy Institute, Sloan Foundation, Swiss National Science Foundation, US National Science Foundation,

White paper referee: Lawrence Berkeley National Laboratory, Union of Concerned Scientists

Departmental Service:

Admissions Chair, UC Berkeley Energy and Resources Group (2013-2017).
Departmental Colloquium Organizer, UC Berkeley Energy and Resources Group (2013-2017).
Member, ERG Faculty Search Committee, (2012-2013, 2015-2016).

Campus Service

UC Berkeley:

Chair, College of Natural Resources Executive Committee (2018-2019)
Member, College of Natural Resources Executive Committee (2017)

Chair, College of Natural Resources Student Faculty Relations Committee (2016-2017)

Member, Graduate Division Fellowships Selection Committee (2017)

Faculty Liaison, The Green Initiative Fund (2015-2017)

Member, Chancellor's Advisory Committee on Dependent Care. (2010-2011)

Faculty Investigator, Center for Information Technology Research in the Interests of Society, UC Berkeley, (2010-present)

Member, Scientific Advisory Board, i4Energy Center, UC Berkeley Center for Information Technology Research in the Interests of Society (2009-2012).

Michigan:

Faculty Adviser, University of Michigan MSA Environmental Issues Committee, (2006-2008)

Faculty Fellow, Michigan Memorial Phoenix Energy Institute, (2007-2009)

Affiliate, Michigan Climate Action Council and Michigan Climate Action Technical Working Group on Cross-cutting Issues (2008).

Community Service

Editor in Chief, Current Sustainable/Renewable Energy Reports (2018-present)

Board of Editors, Energy Informatics (2017-present)

Member, Technical Committee on Smart Grids, IEEE Control Systems Society (2014-present)

Science Adviser for K-8 curriculum on energy, Learning Design Group at the Lawrence Hall of Science (2014-2015)

Co-chair, Working Group on Dynamic Performance of Cyber-Physical Energy Systems, IEEE Power and Energy Society (2013-present).

Guest Editor, IEEE Transactions on Smart Grid, special edition on Control Systems (2013).

Symposium Chair, "Demand Side Management, Demand Response, Dynamic Pricing," 2013 IEEE SmartGridComm (2012-2013).

Guest Editor, Annual Review of Environment and Resources (2012 edition).

Funding

24. "Deep Electrification of Transport in India"

    Sponsor: John D and Catherine T MacArthur Foundation

    PI: Duncan Callaway (as administrative director)

    Co-PIs: Amol Phadke, LBNL (research director)

    Period: 11/2017-10/2020

    Amount: $900,000

23. "Empirical Assessment of Distributed Energy Resources Impacts on California Utility Distribution Systems"

    Sponsor: Sloan Foundation

    PI: Jim Bushnell (UC Davis) (Callaway as sub-contractor)

    Period: 8/2017-10/2020

    Amount: $159,804 (subcontract amount)

22. "CPS: Synergy: Collaborative Research: The Sharing Economy for Electricity Services in Connected Communities"

    Sponsor: National Science Foundation

    PI: Kameshwar Poolla (Callaway as co-PI)

    other Co-PIs: Michael Jordan

    Period: 08/2016-07/2019

    Amount: $900,000

21. "Community Control of Distributed Resources"

    Sponsor: Department of Energy Office of Electricity

    PI: Duncan Callaway (as LBNL Faculty Scientist)

    Co-PIs: Yashen Lin (NREL), Jay Johnson (Sandia)

    Period: 04/2016-04/2019

    Amount: $3,000,000

20. "An Open-source Open-architecture Software Platform for Plug-in Electric Vehicle Smart Charging in California Residential and Small Commercial Settings."

    Sponsor: California Energy Commission

    PI: Tim Lipmann (Callaway as co-PI)

    Period: 04/2016-01/2019

    Amount: $1,500,000

19. "CyberSEES Type 2: Achieving Clean Power System Flexibility: Sensing, Modeling, and Optimal Control"

    Sponsor: National Science Foundation (recommended for funding)

    PI: Duncan Callaway

    Co-PIs: Daniel Kammen and Eric Brewer, UC Berkeley

    Period: 09/2015-08/2019

    Amount: $1,199,914

18. "FEW: Developing Intelligent Food, Energy,and Water Systems (DIFEWS)"

    Sponsor: National Science Foundation

    PI: Matthew Potts, UC Berkeley

    Period: 09/2015-09/2016

    Amount: $49,863

17. "Smart Charging of Plug-in Vehicles and Driver Engagement for Demand Management and Participation in Electricity Markets"

    Sponsor: California Energy Commission Electric Program Investment Charge

    PI: Doug Black, LBNL

Period: 07/2015-06/2018

Amount: $1,993,355

16. "End-to-end Testing of Commercial Building End-Uses for Regulation"

    Sponsor: Consortium for Electric Reliability Technology Solutions (CERTS)

    PI: Duncan Callaway

    Period: 07/2014-06/2016

    Amount: $385,000

15. "CAREER: Aggregation, estimation and control of distributed energy resources"

    Sponsor: National Science Foundation

    PI: Duncan Callaway

    Period: 06/2014-05/2019

    Amount: $400,000

14. "Exploiting Renewable Energies for a Sustainable Power Grid: A generalized aggregate modeling and control architecture for distributed energy resources"

    Sponsor: Tsinghua-Berkeley Fund

    PIs: Duncan Callaway and Qinglai Guo

    Co-PIs: Hongbin Sun and He Hao

    Period: 5/2014-5/2015

    Amount: $50,000 ($25k to Berkeley)

13. "Coordinated Resource Management of Cyber-Physical-Social Power Systems"

    Sponsor: National Science Foundation, Cyber-Physical Systems Program

    PI: Duncan Callaway

    Co-PIs: Eilyan Bitar, Pramod Khargonekar, Kameshwar Poolla, Pravin Varaiya

    Period: 11/2012-10/2015

    Amount: $1,121,717 ($560k to Berkeley)

12. "Coordinated aggregation of distributed resources for the smart grid"

    Sponsor: Bosch Energy Network Research Grant Program

    PI: Kameshwar Poolla

    Co-PI: Pravin Varaiya

    Period: 01/2012-12/2013

    Amount: $200,000 with $200,000 match from UC Berkeley Vice Chancellor for Research

11. "How big is the efficiency resource? Scalable evaluation of building energy efficiency potential and performance."

    Sponsor: UC Berkeley Hellman Faculty Fund

PI: Duncan Callaway

Period: 07/2011-06/2012

Amount: $50,000

10. "Using Existing Metering to Identify Energy Waste in Buildings."

    Sponsor: Center for Information Technology Research in the Interests of Society

    PIs: Ram Akella and Duncan Callaway

    Period: 07/2011-06/2012

    Amount: $75,000

9. "Mitigating renewables intermittency through nondisruptive distributed load control"

    Sponsor: Power Systems Engineering Research Center FutureGrid Initiative

    PI: Duncan Callaway

    Period: 01/2011-12/2012

    Amount: $110,000

8. "Advanced Grid-Interactive Distributed PV and Storage"

    Sponsor: California Solar Initiative (California Public Utilities Commission)

    Joint proposal with SolarCity (lead), Tesla Motors and UC Berkeley

    Berkeley PI: Duncan Callaway,

    Co-PI: Daniel Kammen

    Period: 01/2011-12/2013

    Amount: $1.8M (total), $378,800 (to UC Berkeley)

7. "Modeling of Load Control Strategies to Augment Aggregated Wind Resources."

    Sponsor: California Energy Commission

    PIs: David Auslander and Duncan Callaway

    Period: 10/2010-12/2011

    Amount: $96,000

6. "Modeling of Load Control Strategies to Augment Aggregated Wind Resources."

    Sponsor: California Energy Commission

    PIs: David Auslander and Duncan Callaway

    Period: 08/2009-06/2010

    Amount: $200,000

5. "EFRI-RESIN: A Multi-Scale Design and Control Framework for Dynamically Coupled Sustainable and Resilient Infrastructures, with Application to Vehicle-to-Grid Integration."

   Sponsor: National Science Foundation

   PI: Jeff Stein (Callaway as participating investigator)

   Period: 09/2008-08/2012

   Amount: $2,000,000 (approximately $350,000 to Callaway)

4. "PHEV Pilot Proposal," with DTE Energy and General Motors.

   Sponsor: Michigan Public Service Commission

   U-M PI: Ian Hiskens (Callaway as participating investigator)

   Period: 09/2008-08/2010

   Amount: $5,000,000 ($278,140 subcontract to Callaway)

3. "A Design Science Framework for Measuring Future GHG Emissions in the Energy Sector."

   Sponsor: Michigan Memorial Phoenix Energy Institute

   PI: Steven Skerlos (Callaway as Co-PI)

   Period: 09/2008-08/2009

   Amount: $298,692 ($7,583 to Callaway)

2. "Wind Energy Resource Utilization: An Interdisciplinary Investigation of the Interaction Between Atmosphere and Technology."

   Sponsor: Gilbert Whitaker Fund for the Improvement of Teaching

   PIs: Gerald Keeler and Duncan Callaway

   Period: 05/2008 - 05/2009

   Amount: $10,000

1. "Integrating Resource Assessment, Economics and Public Policy to Optimize Renewable Electricity Generation."

   Sponsor: Michigan Memorial Phoenix Energy Institute

   PI: Duncan Callaway

   Co-PIs: Meredith Fowlie, Greg Keoleian, Tom Lyon, Michael Moore

   Period: 02/2007-05/2009

   Amount: $266,550