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## EDUCATION

Ph.D.  Applied Economics and Management, Cornell University, August 2008.
Dissertation title:  "Three Essays Addressing New Challenges for Energy Policy."
Fields:  Environmental and resource economics, electricity markets, experimental economics, behavioral economics.

B.A.  Economics, with honors, Grinnell College, May 1995.

## REPORTS & OTHER INSTITUTIONAL PUBLICATIONS

I-26. Daniel Shawhan, Kathryne Cleary, Christoph Funke, and Steven Witkin. "The Value of Advanced Energy Funding: Projected Effects of Proposed US Funding for Advanced Energy Technologies." Resources for the Future working paper 21-10. April 2021. https://www.rff.org/publications/issue-briefs/projected-effects-of-proposed-funding-for-advanced-energy-technologies/. Covered by outlets including POLITICO, POLITICO Morning Energy twice, The Washington Examiner, The Hill, and Resources Radio.

I-25. "The Value of Advanced Energy Funding: Analysis for Active Legislative Discussion." Daniel Shawhan, Kathryne Cleary, Christoph Funke, and Steven Witkin. Aug. 13, 2021. https://www.rff.org/publications/issue-briefs/the-value-of-advanced-energy-funding-analysis-for-active-legislative-discussion/.

I-24. Evaluation of Power Sector Emissions Reduction Pathways. Daniel Shawhan and Steven Witkin. July 29, 2021. https://www.rff.org/publications/issue-briefs/evaluation-of-power-sector-emissions-reduction-pathways/.

I-23. "Advanced Clean Energy Infrastructure: Effects of the Draft Energy Infrastructure Act." Daniel Shawhan and Kathryne Cleary. July 14, 2021. https://www.rff.org/publications/issue-briefs/advanced-clean-energy-infrastructure-effects-of-the-draft-energy-infrastructure-act/.

I-22. Daniel Shawhan, Kathryne Cleary, Christoph Funke, and Steven Witkin. "The Value of Advanced Energy Funding: Projected Effects of Proposed US Funding for Advanced

Energy Technologies." Resources for the Future issue brief 21-03. April 28, 2021. https://www.rff.org/publications/working-papers/projected-effects-proposed-us-funding-advanced-energy-technologies/.

I-21. Daniel Shawhan, Christoph Funke, and Steven Witkin. "Benefits of Energy Technology Innovation Part 1: Power Sector Modeling Results." Resources for the Future. Dec. 14, 2020. https://www.rff.org/publications/working-papers/benefits-energy-technology-innovation-power-sector/.

I-20. Paul Picciano, Kevin Rennert, and Daniel Shawhan. "Two Key Design Parameters in Clean Electricity Standards: An illustrative, simulation-based comparison of proposed carbon intensity benchmarks and target escalation methods." Resources for the Future Issue Brief 20-02, February 2020. https://www.rff.org/publications/issue-briefs/key-design-parameters-clean-electricity-standards/.

I-19. United States Climate Alliance. "Strength in Numbers" (2019 Annual Report). https://static1.squarespace.com/static/5a4cfbfe18b27d4da21c9361/t/5df78938e7c320168ad2e19a/1576503687285/USCA_2019+Annual+Report_final.pdf. The US Climate Alliance is an association of the governors' offices of the states that aim to individually achieve the percentage emission reduction committed to by the US government in the Paris climate agreement. Daniel Shawhan, Paul Picciano, and Wes Look produced the state power sector emission projections for the annual report and also produced detailed state-by-state results for the state governors' offices.

I-18. Paul Picciano, Kevin Rennert, and Daniel Shawhan. "Projected Effects of the Clean Energy Standard Act of 2019." Resources for the Future Issue Brief 19-03, May 2019. https://www.rff.org/publications/issue-briefs/projected-effects-clean-energy-standard-act-2019/.

I-17. Shawhan, Daniel, Paul Picciano, and Karen Palmer. "Benefits and Costs of Power Plant Carbon Emissions Pricing in New York." Resources for the Future report, July 18, 2019. https://www.rff.org/publications/reports/benefits-and-costs-of-the-new-york-independent-system-operators-carbon-pricing-initiative/. Reported in S&P Global/Platts, RTOInsider twice, InsideEPA/Climate, Carbon Pulse, Argus, and POLITICO New York twice.

I-16. Shawhan, Daniel, and Paul Picciano. "Retirements and Funerals: The Emission, Mortality, and Coal-Mine Employment Effects of a Two-Year Delay in Coal and Nuclear Power Plant Retirements." Resources for the Future working paper 18-18, July 5, 2018. http://www.rff.org/research/publications/retirements-and-funerals-emission-mortality-and-coal-mine-employment-effects. Cited in Bloomberg, *The Houston Chronicle*, *The Columbus Dispatch*, Axios, *The Washington Examiner*, Utility Dive, and other publications.

I-15. Bistline, John, Daniel Shawhan, Geoffrey Blanford, Francisco de la Chesnaye, Alan Krupnick, Biao Mao, Nidhi Santen, and Ray Zimmerman. "Systems Analysis in Electric Power Sector Modeling: Evaluating Model Complexity for Long-Range Planning." Electric Power Research Institute and Resources for the Future, October 2017. http://www.rff.org/research/publications/systems-analysis-electric-power-sector-modeling-evaluating-model-complexity or https://www.epri.com/#/pages/product/3002011365/.

I-14. U.S. Department of Energy. *Report to Congress on the Valuation of Energy Security for the United States.* January 2017. Author of the electricity portions of chapter 4, "Valuation of Energy Security Benefits in the Oil, Natural Gas, and Electric Power

Sectors." https://energy.gov/policy/downloads/valuation-energy-security-united-states-report-congress

I-13. Shawhan, Daniel. "Optimal Pricing of Electricity in a World with Affordable Distributed Energy." Resources for the Future Policy Brief 16-07, June 9, 2016. http://www.rff.org/research/publications/optimal-pricing-electricity-world-affordable-distributed-energy.

I-12. Alan Krupnick, Daniel Shawhan, and Kristin Hayes. "Harmonizing the Electricity Sectors Across North America: Recommendations and Action Items from Two RFF/US Department of Energy Workshops." Resources for the Future Discussion Paper 16-07, February 2016. http://www.rff.org/research/publications/harmonizing-electricity-sectors-across-north-america-recommendations-and.

I-11. Andrew Kindle, Charles Marquet, Richard Schuler, William Schulze, Daniel Shawhan, Di Shi, Kale Smith, John Taber, Daniel Tylavsky, Jubo Yan, Max Zhang, and Ray Zimmerman. "Mapping Energy Futures: The SuperOPF Planning Tool." A white paper for the US Department of Energy, February 2012.

I-10. Andrew Kindle, Daniel Shawhan, and Michael Swider. "An Empirical Test for Inter-State Carbon-Dioxide Emissions Leakage Resulting from the Regional Greenhouse Gas Initiative." New York Independent System Operator, April 2011. http://www.rff.org/research/publications/empirical-test-inter-state-carbon-dioxide-emissions-leakage-resulting-regional. Covered by SNL (October 13, 2011) and Power News (October 19, 2011).

I-9. "Facilitating Environmental Initiatives While Maintaining Efficient Markets and Electric System Reliability." Power Systems Engineering Research Center. William Schulze, Robert J. Thomas, Timothy Mount, Richard Schuler, Ray Zimmerman, Daniel Tylavsky Daniel Shawhan (principal author), Doug Mitarotonda, and John Taber. https://certs.lbl.gov/sites/default/files/pserc-facilitating-environ-initiatives-2009.pdf.

I-8. Robert J Thomas, Timothy D Mount, Richard E Schuler, William D Schulze, Ray D Zimmerman, Daniel L Shawhan, David Toomey. "Markets for Reactive Power and Reliability: A White Paper." For Federal Energy Regulatory Commission. Engineering and Economics of Electricity Research Group, December 5, 2006. https://e3rg.pserc.cornell.edu/node/100.html

I-7. Daniel Shawhan. "A Burning Problem: Air pollution from power plants and incinerators," D. Shawhan. *The Abell Report*, pp. 1-12, April 2001. The Abell Foundation. Available at http://www.abell.org/sites/default/files/publications/arn501.pdf.

I-2. "A Call for Clean Energy this Earth Day," D. Shawhan and Gaylord Nelson. (Senator Nelson was the founder of Earth Day and lived in Montgomery County, MD.) Op-ed in *The Montgomery Journal*, Montgomery County, Maryland, April 21, 2000.

I-1. "La geotermia: energía limpia y confiable para las américas." Geothermal Energy Association, May 1998. This is a publication about geothermal energy, for distribution throughout the Spanish-speaking parts of the Americas.

**DIRECT POLICY INPUTS**

"RFF Response to US Department of Energy Notice of Intent and Request for Information Regarding Establishment of a Civil Nuclear Credit Program: Comments to the Department of Energy on the establishment of a Civil Nuclear Credit Program." Molly Robertson, Dallas Burtraw, Karen Palmer, and Daniel Shawhan. March 8, 2022.

Extensive input to the "Climate Leadership and Environmental Action for our Nation's Future Act'' or "CLEAN Future Act" of 2021 proposed by Energy and Commerce Committee Chairman Frank Pallone, Jr, Environment and Climate Change Subcommittee Chairman Paul Tonko, and Energy Subcommittee Chairman Bobby L. Rush in March, 2021.

"Informational Testimony on the Maryland Clean and Renewable Energy Standard, HB363/SB265." Daniel L. Shawhan. February 28, 2020.

Extensive input to the "Climate Leadership and Environmental Action for our Nation's Future Act'' or "CLEAN Future Act" proposed by Energy and Commerce Committee Chairman Frank Pallone, Jr, Environment and Climate Change Subcommittee Chairman Paul Tonko, and Energy Subcommittee Chairman Bobby L. Rush on January 28, 2020.

Extensive input to Degette "Clean Energy Innovation and Deployment Act of 2019," introduced in US Congress December 2019.

Significant input to Smith-Lujan "Clean Energy Standard Act of 2019" (US S.1359/H.R.2597)

"Key Considerations for US Climate Policy: Clean Energy Standards & Carbon Pricing." Testimony and Public Comments by Jay Bartlett, Dallas Burtraw, Marc Hafstead, Kristin Hayes, Alan Krupnick, Karen Palmer, Paul Picciano, Kevin Rennert, and Daniel Shawhan. These comments were submitted to the US House of Representatives Select Committee on the Climate Crisis in response to a request for comments. Nov. 22,, 2019.

"Comments on Key Considerations for United States Climate Policy." Public comments from Resources for the Future researchers, submitted to the Committee on Energy and Commerce of the US House of Representatives. Ann Bartuska, Dallas Burtraw, Brian Flannery, Kristin Hayes, Alan Krupnick, Jan Mares, Joshua Linn, Karen Palmer, Brian Prest, Kevin Rennert, and Daniel Shawhan. Sept. 13, 2019. https://www.rff.org/publications/testimony-and-public-comments/comments-key-considerations-united-states-climate-policy/.

Comments to US Federal Energy Regulatory Commission (FERC) on potential Grid Resiliency Pricing Rule (Docket RM18-1-000) proposed to FERC by US Secretary of Energy, November 2017. These comments included a research paper that uses the E4ST model of the power system to project the effects of the proposed rule. Paper is entitled "Costs and Benefits of Saving Unprofitable Generators: A Simulation Case Study for US Coal and Nuclear Power Plants." One of the commissioners then cited it in FERC's ruling document. D. Shawhan and P. Picciano.

Official joint comments of Maryland Public Interest Research Group, Natural Resources Defense Council, Northeast Energy Efficiency Partnerships, American Council for an Energy Efficient Economy, Alliance to Save Energy, and Chesapeake Bay Foundation to the Maryland Public Service Commission on energy conservation and efficiency programs, June 30, October 18, and December 15, 2000. D. Shawhan, S. Coakley, S. Nadel, E. Osann, T. Pierno, B. Prindle.

Maryland renewable energy portfolio standard bill, 2000 and 2001. D. Shawhan with Maryland Department of Legislative Services. A modified version of this bill became law in 2004.

"The Potential Exercise of Horizontal Market Power in a Deregulated Colorado Electricity Market." D. Shawhan and R. Rosen, June 1999. Presented by Colorado Office of Consumer Counsel to Colorado Electricity Advisory Panel.

Several sets of official comments on restructuring issues submitted by Arizona Residential Utility Consumer Office to Arizona Corporation Commission. D. Shawhan and R. Rosen, September 1998-April 1999.

## PEER-REVIEWED JOURNAL ARTICLES

*For more information about the power sector simulation work that includes some of the papers below, see www.E4ST.org.*

J8. D. Shawhan and P. Picciano, "Costs and Benefits of Saving Unprofitable Generators: A Simulation Case Study for US Coal and Nuclear Power Plants." *Energy Policy*, Volume 124, January 2019, Pages 383-400, https://doi.org/10.1016/j.enpol.2018.07.040. Working paper version at http://www.rff.org/research/publications/costs-and-benefits-saving-unprofitable-generators-simulation-case-study-us. Cited in Federal Energy Regulatory Commission ruling document on the "Grid Resiliency Pricing Rule." Cited in *The New York Times*, *The Houston Chronicle*, *The Washington Post*, *The Globe and Mail*, *Scientific American*, *The Washington Examiner*, VOX, Axios Generate, and other publications.

J7. C. Fischer, B. Mao, and D. Shawhan, "Trade between Mass- and Rate-Based Regulatory Regimes: Bad for Emissions?" *Energy Economics*, Volume 73, June 2018, Pages 326-336. https://doi.org/10.1016/j.eneco.2018.04.031.

J6. D. Shawhan, "Co-Emission and Welfare Effects of Electricity Policy and Market Changes: Results from the EMF 32 Model Intercomparison Project." *Energy Economics*, Volume 73, June 2018, Pages 380-392. https://doi.org/10.1016/j.eneco.2018.03.034.

J5. Alberto J. Lamadrid, Daniel L. Shawhan, Carlos Murillo-Sanchez, Ray D. Zimmerman, Yujia Zhu, Daniel J. Tylavsky, Andrew G. Kindle, and Zamiyad Dar, "Stochastically Optimized, Carbon-Reducing Dispatch of Storage, Generation, and Controllable Loads." *IEEE Transactions on Power Systems*, Vol. 30, Issue 2 (March 2015), pp. 1064–1075. http://dx.doi.org/10.1109/TPWRS.2014.2388214

J4. Daniel L. Shawhan, John T. Taber, Di Shi, Ray D. Zimmerman, Jubo Yan, Charles M. Marquet, Yingying Qi, Biao Mao, Richard E. Schuler, William D. Schulze, and Daniel J. Tylavsky, "Does a Detailed Model of the Electricity Grid Matter? Estimating the Impacts of the Regional Greenhouse Gas Initiative," *Resource and Energy Economics*, Volume 36 Issue 1, January 2014, pp. 191–207. http://dx.doi.org/10.1016/j.reseneeco.2013.11.015

J3. Yu Xia, Scott G. Ghiocel, Daniel Dotta, Daniel Shawhan, Andrew Kindle, and Joe H. Chow, "A Simultaneous Perturbation Approach for Solving Economic Dispatch Problems with Emission, Storage, and Network Constraints," *IEEE Transactions on Smart Grid*, Vol. 4, Issue 4 (December 2013), pp. 2356-2363. http://dx.doi.org/10.1109/TSG.2013.2263111

J2. Daniel Shawhan, Kent Messer, William Schulze, and Richard Schuler, "An Experimental Test of Automatic Mitigation of Wholesale Electricity Prices." *International Journal of Industrial Organization* 29 (2011) 46-53. http://dx.doi.org/10.1016/j.ijindorg.2010.06.005

J1. Jeffrey Prince and Daniel Shawhan, "Is Time Inconsistency Primarily a Male Problem?" *Applied Economics Letters*, Volume 18 Issue 6, April 2011, pp. 501-504. http://dx.doi.org/10.1080/13504851003761806

## PEER-REVIEWED CONFERENCE PROCEEDINGS JOURNAL ARTICLES

C6. Biao Mao, Daniel Shawhan, Ray Zimmerman, Jubo Yan, Yujia Zhu, William Schulze, Richard Schuler, Daniel Tylavsky. "The Engineering, Economic and Environmental Electricity Simulation Tool (E4ST): Description and an Illustration of its Capability and Use as a Planning/Policy Analysis Tool." *Proceedings of the 49th Annual Hawaii International Conference on System Sciences*, Computer Society Press, January 2016, pp. 2317-2325. http://doi.ieeecomputersociety.org/10.1109/HICSS.2016.290. Won best paper in the electric energy systems track, out of 70 submitted and 32 presented.

C5. Lamadrid, A. J., Shawhan, D. L., Murillo-Sanchez, C. E., Zimmerman, R. D., Zhu, Y., Tylavsky, D. J., Kindle, A., and Dar, Z. (2015). Economic cost-benefit analysis for power system operations with environmental considerations. In 2015 IEEE Eindhoven PowerTech, PowerTech 2015 [7232802]. Institute of Electrical and Electronics Engineers Inc.. DOI: 10.1109/PTC.2015.7232802.

C4. Daniel Shawhan, John Taber, Ray Zimmerman, Jubo Yan, Charles Marquet, William Schulze, Richard Schuler, Robert Thomas, Daniel Tylavsky, Di Shi, Nan Li, Ward Jewell, Trevor Hardy, and Zhouxing Hu. "A Detailed Power System Planning Model: Estimating the Long-Run Impact of Carbon-Reducing Policies." *Proceedings of the 48th Annual Hawaii International Conference on System Sciences*, Computer Society Press, January 2015, pp. 2497-2506. http://doi.ieeecomputersociety.org/10.1109/HICSS.2015.300. HICSS peer review and impact factor information at http://hicss.hawaii.edu/tracks-and-minitracks/authors/.

C3. J. Taber, D. Shawhan, R. Zimmerman, C. Marquet, M. Zhang, W. Schulze, R. Schuler, S. Whitley, "Mapping Energy Futures Using The SuperOPF Planning Tool: An Integrated Engineering, Economic and Environmental Model." *Proceedings of the 46th Annual Hawaii International Conference on System Sciences*, Computer Society Press, January 2013, pages 2020-2029. http://doi.ieeecomputersociety.org/10.1109/HICSS.2013.391.

C2. N. Li, D. Shi, D. Shawhan, D. J. Tylavsky, J. Taber, R. Zimmerman, "Optimal Generation Investment Planning: Part 2: Application to the ERCOT System," *North American Power Symposium* 2012 (electronic journal), September 2012, 6 pages. http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=6336374.

C1. D. Shi, D. Shawhan, N. Li, D. J. Tylavsky, J. Taber, R. Zimmerman, "Optimal Generation Investment Planning: Part 1: Network Equivalents," *North American Power Symposium* 2012 (electronic journal), September 2012, 6 pages. http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=6336375.

## BOOK CHAPTERS & OTHER WORKS IN EDITED VOLUMES

B3. Shawhan, Daniel L. "Using stated preferences to estimate the value of avoiding power outages: A commentary with input from six continents." In Peter Larsen, Alan Sanstad, Kristina Hamachi LaCommare, and Joe Eto, editors, *Frontiers in the Economics of*

*Widespread, Long-Duration Power Interruptions*. Lawrence Berkeley National Laboratory, 2019. https://emp.lbl.gov/publications/frontiers-economics-widespread-long.

B2. "Tradable Permit Markets," Dallas Burtraw and Daniel Shawhan. In Todd Cherry, Stephan Kroll, and Jason Shogren, eds, *Experimental Methods, Environmental Economics*, UK: Routledge, 2007.

B1. Daniel Shawhan, "Renewable Energy." In *U.S. Energy 1997*, Washington DC: United States Energy Association, 1997.

**MAGAZINE ARTICLES**

Karen Palmer, Devin Hartman and Daniel Shawhan. "Understanding grid resilience implications for market design: Beyond the NETL study." Utility Dive, April 24, 2018. https://www.utilitydive.com/news/understanding-grid-resilience-implications-for-market-design-beyond-the-ne/522052/.

D. Shawhan and P. Picciano, "RFF Experts Project the Impact of DOE's Grid Resiliency Pricing Proposal." *Resources*. Issue 196 (Winter 2017). http://www.rff.org/research/publications/rff-experts-project-impact-does-grid-resiliency-pricing-proposal. Includes interactive charts.

Alan Krupnick, Daniel Shawhan, and Kristin Hayes. "Harmonizing North American Electricity Policy and Planning: An Action Agenda." *Resources*, Spring/Summer 2016, pp. 35-39. http://www.rff.org/research/publications/harmonizing-north-american-electricity-policy-and-planning-action-agenda.

**DATASETS**

D. Shawhan, C. Marquet, and J. Yan, Augmented Energy Information Administration Generation Unit Dataset. This database of the 16,000 grid-connected, utility-scale electricity generation units in the contiguous US combines data about them from Energy Information Administration (EIA) and Environmental Protection Agency (EPA) datasets, with missing values filled in via statistical methods. The EIA and EPA datasets, which use different generator numbering conventions and do not contain directly comparable information conducive to matching, were matched based on a sophisticated algorithm. The result is a dataset that contains the heat rate, emission rates, emission control characteristics, fuel type, age, annual usage, EPA unit number, and more, for each generator.

D. Shawhan, C. Marquet, and J. Yan, US-Canadian Comprehensive Generator Dataset. Available at E4ST.com, except the portions owned by Energy Visuals, Inc.

A. Kindle, D. Shawhan, and Z. Dar, Hourly Wind, Sun, and Electric Load at Each High-Voltage Grid Node in a Recent Year. Three datasets covering, respectively, the eastern, western, and Texas grids of the US and Canada. Available at E4ST.com.

Z. Dar and D. Shawhan, Thirty-Eight Hours that Represent a Recent Year. Three datasets covering, respectively, the eastern, western, and Texas grids of the US and Canada. Available at E4ST.com, except the portions owned by Energy Visuals, Inc.

## SOFTWARE

P. Picciano and D. Shawhan, A MATLAB replica of the Co-Benefits Risk Assessment (COBRA) air pollution transport-and-fate model of the US, capable of simulating scenarios in large batches. (COBRA is a web-based model maintained and updated by Abt Associates for the US EPA, capable of simulating one scenario at a time.)

A. Bostian, R. Bharvirkar, and D. Shawhan, Multi-player simulations of Indian electricity market design and an alternative design based on uniform-price auctions.

C. Marquet, P. Picciano, and D. Shawhan, Software to Match Energy Information Administration Generators with Environmental Protection Agency Generators.

Z. Dar, P. Picciano, and D. Shawhan, Software for Choosing Representative Hours to Include Each Region's Times of Maximum Regional Generation Scarcity.

P. Picciano, D. Shawhan, and J. Yan, Electric Generator Aggregation Software.

C. Marquet, P. Picciano, and D. Shawhan, Software to Calculate Health Damages from Pollutant Concentrations.

P. Picciano, D. Shawhan and J. Yan, Software to Match Energy Information Administration Databases and Calculate Effective Stack Heights.

C. Marquet and D. Shawhan, Software to Estimate Missing Values in US-Canadian Comprehensive Generator Dataset.

C. Marquet and D. Shawhan, Software for Placing EIA Generators in Energy Visuals Grid Models when Coordinates are Unreliable.

## GRANTS AND CONTRACTS

### Funding to Resources for the Future

Post-2017 funding is reflected in Resources for the Future annual reports.

North American electric power and natural gas sector modeling. From US National Science Foundation to Resources for the Future, 2015 – 2017. PI: Alan Krupnick. Award no. 1559339.

"Systems Analysis in the Electricity Sector." From US National Science Foundation to Resources for the Future, Summer 2016 – Spring 2017. PI: Alan Krupnick.

Principal investigator, "Economic and Emission Impacts of U.S. Offshore Windfarms." From US Bureau of Ocean Energy Management to Resources for the Future via Industrial Economics, Inc. Fall 2016 – Spring 2017.

Electricity Sector Literature Review. US National Science Foundation to Resources for the Future. PI: Alan Krupnick.

Principal investigator, "Mapping Energy Futures: The SuperOPF Planning Tool." From US Department of Energy via Lawrence Berkeley National Lab (Subcontract 7110828) to Resources for the Future. Summer 2015 – Summer 2016.

Principal investigator, "Mapping Energy Futures: The SuperOPF Planning Tool." From US Department of Energy via Lawrence Berkeley National Lab to Resources for the Future. Summer 2014 – Summer 2015.

**Funding to Rensselaer Polytechnic Institute**

Principal investigator, "Mapping Energy Futures: The SuperOPF Planning Tool." From US Department of Energy via Lawrence Berkeley National Lab to Rensselaer Polytechnic Institute. Summer 2015 – Summer 2016.

Principal investigator, "Mapping Energy Futures: The SuperOPF Planning Tool." From US Department of Energy via Lawrence Berkeley National Lab to Rensselaer Polytechnic Institute. Summer 2014 – Summer 2015.

Principal investigator, "Development of SuperOPF Planning Tool." From New York Independent System Operator. 2014.

Principal investigator, "CERTS Power System Research: Mapping Energy Futures with the SuperOPF Planning Tool." From US Department of Energy via Lawrence Berkeley National Lab. Summer 2013 – Summer 2014.

Principal investigator, Rensselaer subcontract of "Eliminating Transmission Line Losses Through Replacement of Shield Wires the Use of Arresters." From New York State Energy Research and Development Authority to Ceralink Inc. 2012-13.

Principal investigator, "SuperOPF Planning Tool Development and Application to New York." From New York Independent System Operator. 2013.

Power Market Structures subthrust leader and co-author, "Center for Ultra-wide-area Resilient Electric Energy Transmission Networks" (CURENT), National Science Foundation Engineering Research Center co-funded by NSF and US Department of Energy. Anticipated duration: 2011 – 2021 or beyond. Co-author of initial proposal (2010-2011), responses to reviewer questions, annual reports, and new annual proposals for successful renewal in 2012, 2013, and 2014.

Co-author and subtask leader, "Scalable and flat controls for reliable power grid operation with high renewable penetration." From the Global Climate and Energy Program at Stanford University, which is funded by ExxonMobil, General Electric, Schlumberger, and Toyota. 2010-2014.

Co-founder and co-author, "New York Energy Policy Institute." Announced December 2009. An initiative of New York's governor, announced in his 2009 State of the State address. Seed funding from New York Energy Research and Development Authority. The three core institutions are Stony Brook University, Rensselaer, and Syracuse University.

Principal investigator, Rensselaer portion of "CERTS Power System Research: Mapping Energy Futures: The SuperOPF Planning Tool." From US Department of Energy to Rensselaer via Lawrence Berkeley National Lab. 2012.

Principal investigator, "SuperOPF Planning Tool Development and Application to New York." From New York Independent System Operator. 2012.

Principal investigator, "The Impact of New Energy and Environmental Regulations on the Future Reliability and Costs of Electric Power." From US Department of Energy via Lawrence Berkeley National Lab. 2011.

Principal investigator, subcontract of "The Impact of New Environmental Regulations on the Future Reliability and Costs of Electric Power," from US Department of Energy via Cornell University. 2010.

**Funding to Cornell University**

Co-leader and co-author, "Budget Supplement for PSERC project M-20, 'Facilitating Environmental Initiatives While Maintaining Efficient Markets and Electric System Reliability,'" New York Independent System Operator contract to a team consisting of Douglas Mitarotonda, William Schulze, and Daniel Shawhan. Fall 2008-Fall 2009. Proposal authors: Shawhan and Schulze.

Co-author, "Assessing Gender Differences in Time Consistency," Institute for Social Sciences, Cornell University. 2006.

Co-author, "An Experimental Economics Examination of Behavioral Anomalies, Group Decision Making, and the Provision of Public Goods," National Science Foundation award SES-0418450, August 2004-July 2006. Principal investigator: William Schulze.

**Funding prior to graduate school**

Principal investigator and author, "Sustainable Energy Solutions for Maryland," grant by The Energy Foundation to the MaryPIRG Foundation, awarded December 2001.

Principal investigator and author, "General Support," grant by The Beldon Fund to the MaryPIRG Foundation, awarded December 2001.

Principal investigator and author, "Exploring a Clean Energy Future for Maryland in a Deregulated Electricity Market," grant by The Energy Foundation to the MaryPIRG Foundation, awarded March 2000.

Principal author of two successful proposals for state government consulting contracts on electricity market restructuring. Contributed to nine other proposals. Tellus Institute, June 1998 – September 1999.

**CONFERENCE PRESENTATIONS**

"Projected Effects of Proposed US Funding for Advanced Energy Technology Development." Daniel Shawhan, Kathryne Cleary, Christoph Funke, and Steven Witkin. Society for Benefit-Cost Analysis annual conference, March 2022.

"Your Money or Your Wildlife: Environmental and Economic Tradeoffs from Solar Siting Restrictions in Texas." Allied Social Sciences Associations meetings, San Diego, California, January 5, 2020.

"Your Money or Your Wildlife: Environmental and Economic Tradeoffs from Solar Siting Restrictions in Texas." Southern Economic Association annual conference, Fort Lauderdale, Florida, November 24, 2019.

"An Emission Tax Within an Emission-Capped Region is Not Necessarily Welfare Reducing: Lessons from the New York Carbon Adder." Association of Environmental and Resource Economists annual conference, Lake Tahoe, Nevada, May 31, 2019.

"Benefits and Costs of Offshore Wind at Nine Eastern and Western US Sites." Northeastern Agricultural and Resource Economics Association meetings, Arlington, Virginia, June 12, 2017.

"Effects of Efficient Environmental Damage Pricing in the Power Sector." Association of Environmental and Resource Economists annual conference, San Diego, June 4, 2015.

"Benefit-Cost Analysis of Efficient Emission Pricing in the Power Sector." Society for Benefit-Cost Analysis annual conference, Washington DC, March 20-21, 2015.

"Cost-Benefit Analysis of Five Power System Changes Using Hybrid Stochastic-Robust Optimized Dispatch of Storage, Generation, and Loads." FERC /Trans-Atlantic Infraday Workshop on Electricity Markets and Planning, Washington DC, November 6, 2014.

"Internalizing the Environmental Externalities of Power Generation in the USA: Exploration of the Effects Using an Air Pollution Model and a New National Grid Model." International Association of Energy Economists world conference, New York, June 17, 2014.

"Location, Location, Location in Air Pollution Regulation: Using Location to Improve the Regulation of Power Plant Emissions." Northeastern Agricultural and Resource Economics Association Meetings, Morgantown, West Virginia, June 1-3, 2014.

"Emission Functions for Electricity Generators, and How They Help Resolve a Controversy About the Emission Effects of Wind Power." Northeastern Agricultural and Resource Economics Association Meetings, Morgantown, West Virginia, June 1-3, 2014.

"Does a Detailed Model of the Electricity Grid Matter? Estimating the Impacts of the Regional Greenhouse Gas Initiative." Federal Energy Regulatory Commission Energy Workshop: New Methods and Models for Improving the Efficiency of Power Grid Operations and Planning: Dealing with Nonconvexities and Variable Renewables. Washington, DC, November 7, 2013

"An Advanced, Open-Source Model for Predicting the Effects of Power-Sector Policies and Investments." International Association of Energy Economists conference, Düsseldorf, Germany, August 18–21, 2013.

"Improved Emission Functions for Generators, and How They Help Resolve a Controversy About the Emission Effects of Wind Power." International Association of Energy Economists conference, Düsseldorf, Germany, August 18–21, 2013.

"Estimating the Long-Run Effects of Environmental Policies on the Electricity Grid: Prices, Investment, Demand Response, and Resulting Carbon Dioxide Emissions." Mannheim Energy Conference, Centre for European Economic Research (ZEW), Mannheim, Germany, June 24–25, 2013.

"Estimating the Long-Run Effects of Environmental Policies on the Electricity Grid: Prices, Investment, Demand Response, and Resulting Carbon Dioxide Emissions." International Energy Agency's International Energy Workshop, Paris, France, June 19–21, 2013.

"Environmental Policies on the Grid: Predicting Long-Term Impacts with a New Economic-Engineering-Environmental Model." US Society for Ecological Economics conference, University of Vermont, Burlington, Vermont, June 10, 2013.

"An Advanced, Open-Source Model for Predicting the Effects of Power-Sector Policies and Investments." Center for Future Energy Systems conference, Troy, NY, January 25, 2013.

"An Advanced, Open-Source Model for Predicting the Effects of Power-Sector Policies, Investments, and Prices." US & International Associations of Energy Economists Conference, Austin, TX, November 4–7, 2012.

"Environmental Policies on the Grid: Findings from an Integrated Economic, Engineering, and Environmental Model." Plenary presentation at national symposium "Power Generation and the Environment: Choices and Economic Trade-Offs," hosted in Jackson Hole, Wyoming by the University of Wyoming, October 1–2, 2012.

"An Advanced Method of Predicting Electric Energy Policy Outcomes, with an Application to Carbon Dioxide Emission Reduction Policy." Association of Public Policy Analysis and Management Fall Conference, Boston, MA, November 4, 2010.

"An Economic and Engineering Analysis of Incentive-Based Carbon Dioxide Emission Reduction Policies in the Power Sector," Association of Public Policy Analysis and Management Fall Conference, Washington, DC, November 2009.

"An Experimental Test of Automatic Mitigation of Wholesale Electricity Prices," Association of Public Policy Analysis and Management Fall Conference, Washington, DC, November 2009.

"An Economic and Engineering Analysis of Incentive-Based Carbon Dioxide Emission Reduction Policies in the Power Sector," Association of Environmental and Resource Economists Summer Workshop, Washington DC, June 2009. (11 of 70 submitted papers were accepted for presentation.) The workshop drew an audience of approximately 100 researchers and government officials.

"Time Inconsistency in Public Decision-Making: Experimental Evidence and Social Consequences," Rensselaer Economics Department seminar, November 12, 2008.

"A Regional Incentive-Based Carbon Dioxide Emission Regulation in the Power Sector: Impacts Predicted Using an Alternating-Current Model." Association of Environmental and Resource Economists session of Agricultural and Applied Economics Association conference, Orlando, FL, July 28, 2008.

## INVITED LECTURES & PRESENTATIONS

"REBA Fall Forum: Latest and greatest research on decarbonization pathways." Renewable Energy Buyers' Alliance Fall Forum: Latest and greatest research on decarbonization pathways. November 18, 2021.

"Clean Energy Innovation: How Beneficial is Government Funding?" Resources for the Future online event. July 30, 2021. https://www.rff.org/events/advanced-energy-technologies-series/clean-energy-innovation-how-beneficial-is-government-funding/.

The Dollar Value of Energy Innovation, with Daniel Shawhan. Resources Radio. June 15, 2021. https://www.resources.org/resources-radio/the-dollar-value-of-energy-innovation-with-daniel-shawhan/.

"E4ST Modeling, and Some Suggestions Related to Power Sector Modeling." Presentation to National Academies panel on the future of the power grid. Irvine, CA. Feb. 3, 2020.

"Clean Energy Standards and Alternative Policy Mechanisms for Electricity Sector Decarbonization: An Overview and Comparative Analysis." Briefing for US Congressional staff. Washington, DC. October 30, 2019.

"Considerations for Crediting Under a Federal Clean Energy Standard." Briefing to environmental organizations and others at a clean energy standard design workshop at the Bipartisan Policy Center. Washington, DC. October 4, 2019.

A New York State of Carbon Pricing, with Karen Palmer and Daniel Shawhan. Resources Radio. Sept. 30, 2019. https://www.resources.org/resources-radio/new-york-state-carbon-pricing-karen-palmer-and-daniel-shawhan/.

"El Modelo E4ST y Ejemplos de su Uso." Four seminars with planning division of Centro Nacional de Control de Energía (CENACE, national electric power system operator), with interested faculty and students at the Instituto Tecnológico Autónomo de México (ITAM), with the transmission tariff managers at the Comisión Reguladora de Energía (CRE), and with electric system data manager and staff at the Secretaría de Energía (SENER), Mexico City, March 20-22, 2018.

"Nuclear Unit Economics in Power Sector Projections," US Environmental Protection Agency, January 3, 2018.

"Simulation Modeling and Experiments for Predicting the Effects of Market Designs, Policies, and Investments." Duke Kunshan University, Duke University, Resources for the Future, and Renmin University of China workshop, "China's Electricity Reform," Beijing, June 27, 2017.

"Power Sector Reform and Its Role in Reducing Air Pollution." Presentation to Chinese National Development and Reform Commission and Chinese Ministry of Science officials, Chinese embassy, Washington DC, April 12, 2017.

"Power Sector Reform and Its Role in Moving Toward a Low Emission Power System." Rock Energy & Environment Institute Workshop, "Toward a Sustainable and Healthy Energy System in China," Beijing, October 20, 2016.

"Simulation of NY Clean Energy Standard and Regional Greenhouse Gas Initiative Options," presentation to the mayor's climate policy staff, City of New York, July 11, 2016.

"Review of the Engineering, Economic, and Environmental Electricity Simulation Tool (E4ST)," US Department of Energy Center for Electric Reliability Technology Solutions annual Reliability and Markets Conference. Arlington, VA. June 9-10, 2016.

"India Deep Dive: Distribution-Sector Reforms," Regulatory Assistance Project annual meetings, Montreal, June 6-9, 2016. With Ranjit Bharvirkar and AJ Bostian.

"Simulation of NY Clean Energy Standard and Regional Greenhouse Gas Initiative Options." Meeting of the Environmental Advisory Council of the New York Independent System Operator, Albany, New York, May 6, 2016.

"Clean Energy Portfolio Standards and Deployment Subsidies." 20th Washington Energy Policy Conference of the National Capital Area Chapter of the US Association for Energy Economics, Washington DC, April 13, 2016.

"E4ST: A New Simulation Model for Power Sector Policy & Investment Analysis," US Department of Energy Office of Energy Policy and Systems Analysis Seminar, January 20, 2016.

"E4ST: A New Simulation Model for Power Sector Policy & Investment Analysis," US Department of Energy Office of Electricity Seminar, January 20, 2016.

"E4ST: A New Simulation Model for Power Sector Environmental Policy Analysis," US Environmental Protection Agency seminar, January 4, 2016.

"The $E^4$ Simulation Tool: A New Tool and Data for Electricity Policy Analysis, Projections, and Project Evaluation." US Department of Energy seminar, Washington DC, Dec. 12, 2014.

"Some New Open-Source Tools for Evaluating Power System Investments and Predicting Capacity Changes." US Federal Energy Regulatory Commission seminar, Washington DC, December 11, 2014.

"Mapping Energy Futures." US Department of Energy Center for Electric Reliability Technology Solutions annual Reliability and Markets Conference. Cornell University, Ithaca, NY, August 5-6, 2014.

"Optimal Emission Pricing, Simulated Using a Power Grid Model and an Air Pollution Model." Resources for the Future seminar, July 10, 2014.

"The Environmental Impacts of Power Plant Emissions: A Detailed Economic-Engineering-Environmental Model of the Eastern Interconnection." Meeting of the Environmental Advisory Council of the New York Independent System Operator, Albany, New York, May 30, 2014.

"Simulation Modeling of Power Plant Emission Regulations: Using a Detailed Economic-Engineering-Environmental Model to Evaluate Policies," Johns Hopkins University, Baltimore, Maryland, January 28, 2014.

"The SuperOPF Planning Tool for Grid Planning and Policy Analysis: Test of Model Simplification in Application to Regional Greenhouse Gas Initiative," Center for Climate and Electricity Policy seminar, Resources for the Future, Washington DC, Nov. 19, 2013.

"Including Environmental Costs in Levelized Cost of Energy," Georgia Tech Clean Energy Seminar Series, Atlanta, Georgia, September 25, 2013. Viewable at http://secleanenergy.gatech.edu/video-archive/.

"Emission Reductions and 'Leakage' from US State Cap-and-Trade Programs," Resources for the Future workshop: Retrospective Analysis of US Climate Policy, Washington, DC, September 19, 2013.

"Accomplishments in the Last 12 Months." US Department of Energy Center for Electric Reliability Technology Solutions annual Reliability and Markets Conference. Cornell University, Ithaca, NY, August 6-7, 2013.

"Some Roles of Economics in Ultra-Wide-Area Power Systems," Center for Ultra-wide-area Resilient Electric Energy Transmission Networks seminar, simulcast at University of Tennessee, Rensselaer Polytechnic Institute, Tuskegee University, and Northeastern University, November 13, 2012.

"Eastern Interconnection Model Information Overview." Presentation to leaders of the Eastern Interconnection Planning Collaborative, at New York Independent System Operator headquarters, Rensselaer, NY, May 3, 2012.

"Toward a Lower-Cost, Less-Polluting Power Grid: A Preliminary 'Super OPF' Power System Planning Tool and a Few Applications." Department of Electrical Engineering weekly seminar, State University of New York at Buffalo, April 20, 2012.

"The SuperOPF Planning Tool." US Department of Energy Center for Electric Reliability Technology Solutions annual Reliability and Markets Conference. Cornell University, Ithaca, NY, August 7–8, 2012.

"Simulation of Grids and Storage Devices on Them," at Rensselaer Energy Storage Workshop, Troy, NY, February 22, 2012.

"The Impact of New Energy and Environmental Regulations on the Future Reliability and Costs of Electric Power." US Department of Energy Center for Electric Reliability Technology Solutions annual Reliability and Markets Conference. Cornell University, Ithaca, NY, August 2-3, 2011.

"Incentive-Based CO2 Regulations: Some Upcoming Policy Decisions." US Department of Energy Center for Electric Reliability Technology Solutions annual Reliability and Markets Conference. Cornell University, Ithaca, NY, August 11-12, 2010.

"The Effects of Regulating $CO_2$ and Fine Particulates on the Northeast Power System: An Economic and Engineering Analysis of Environmental Dispatch." Presentation to New York Independent System Operator president and CEO Steve Whitley and smart grid research director Dejan Sobajic about advanced modeling of the economic, environmental, and health effects of environmental and other policies applied to the electric power sector. April 8, 2010, at Cornell University in Ithaca, NY.

"An Economic and Engineering Analysis of Incentive-Based Carbon Dioxide Emission Reduction Policies in the Power Sector." Presentation to a meeting of fellow GE, IBM, and RPI researchers and managers regarding faster-than-real-time simulation of power system. My topics were policy applications of such a simulation capability, and

improvement of the economic efficiency of power system control. April 5, 2010, at GE Global Research Center in Niskayuna, NY.

"The Effects of Regulating $CO_2$ and Fine Particulates on the Northeast Power System: An Economic and Engineering Analysis," New York Independent System Operator Environmental Advisory Committee meeting, October 22, 2009.

"Integrating Operational Reliability and Planning: The Effects of Regulatory Constraints on Reliability and the Impact of Environmental Regulation." US Department of Energy Center for Electric Reliability Technology Solutions Annual Reliability and Markets Conference. Cornell University, Ithaca, NY, August 6, 2009.

"Facilitating Environmental Initiatives While Maintaining Efficient Markets and Electric System Reliability," research presentation to the CEO and two of the vice presidents of the New York Independent System Operator, the organization that runs the New York electric power grid and wholesale market, July 17, 2009.

"An Economic and Engineering Analysis of the Impact of Carbon Dioxide Regulation on Emissions and Costs from Electric Power," Rensselaer Ecological Economics Seminar, February 2009.

"Two Studies Underway on The Impact of Environmental Regulation." Presentation to leadership and staff of Markets Division of New York Independent System Operator, February 2009.

"Environmentalism and Economics" (topic provided by organizers), keynote address at Doane Stuart High School's school-wide conference on environmentalism, January 23, 2009.

"Time Inconsistency in Public Decision-Making: Experimental Evidence and Social Consequences," Department of Economics, Rensselaer Polytechnic Institute, November 12, 2008.

"Design and Regulation of Electricity Markets," Lally School Enterprise and Economic Development Seminar 2008–2009 inaugural session, September 3, 2008.

## COURSES TAUGHT

Managerial Economics (similar to Intermediate Microeconomics), ECON 2010, Rensselaer Polytechnic Institute, Fall 2014, Spring 2013 (two sections), Fall 2012, Spring 2012 (two sections), Fall 2011, Spring 2011 (two sections), Fall 2010, Spring 2010.

Electricity Economics and Policy, ECON 6960/4960 or 6962/4962, graduate/undergraduate course, Rensselaer Polytechnic Institute, Fall 2014, Fall 2012, Fall 2010.

Advanced Environmental Economics, ECON 6230, Ph.D. core course, Rensselaer Polytechnic Institute, Fall 2011, Fall 2009, Fall 2008.

Electricity Policy Readings Course, ECON 2940/4940/6940, Polytechnic Institute, Spring 2010.

Energy Economics and Policy, ECON 6961/4961, graduate/undergraduate course, Rensselaer Polytechnic Institute, Spring 2009.

Environmental Economics, ECON 409/AEM 451, undergraduate course, Cornell University, Spring 2008 and Spring 2007.

Resource and Environmental Economics, AEM 651, master's-level course, Cornell University, Spring 2007.

**STUDENT ADVISING** *(All at Rensselaer Polytechnic Institute)*

**Doctoral student advising**

Advisor of RPI Department of Economics PhD student Biao Mao, August 2012–May 2017 completion.
Advisor of RPI Department of Economics PhD student Andrew Kindle, August 2010–May 2015 completion.
Advisor of RPI Department of Electrical, Computer, and Systems Engineering PhD student Zamiyad Dar, September 2013–December 2014, when he chose an advisor in his department, as required by his department.
Initial advisor for RPI PhD student Department of Economics PhD student Yu-li Ko, August 2010–2012.

**Advisor of Master's degree theses**

Zamiyad Dar (Electrical, Computer, and Systems Engineering). Completed December 2014. "Optimization and Simulation of Wide-Area Power System Operation with Intertemporal Constraints."
Kedaar Raman (Electrical, Computer, and Systems Engineering), "The Effects of Generator Operation on Emissions." Completed November 2013.
Ellen Roybal, "Prices vs. Quantities: A Review and Comparison with Application to Carbon Emission Abatement." Completed Spring 2012.
Veronica Wang, "Econometric Prediction of Air Pollution Transfer Coefficients for Canada." Completed Summer 2010.

**PhD committee membership, Rensselaer Polytechnic Institute (of students in Department of Economics, unless otherwise specified)**

Xinyu Tony Jiang (Electrical, Computer, and Systems Engineering; graduated 2014).
Liliana Martinez (graduated 2014).
Scott Ghiocel (Electrical, Computer, and Systems Engineering; graduated 2013).
Pamela Harper (Management) (graduated 2012).
Sarah Parks, (graduated 2012).
Xiaohua Wu (Industrial and Systems Engineering), 2010–2012.
Nat Springer (graduated 2011).
Sean Ferguson (Science and Technology Studies), 2010–2011.
Nancy Sanhueza-Diaz, 2010–2011.
Sung Kim (graduated 2010).
Carlos Lopez (graduated 2010).
Aneel Salman (graduated 2010).

**M.S. committee membership**

Yu Xia (Electrical, Computer, and Systems Engineering, graduated 2013)

**Undergraduate project supervision**

Andrew Bolin, Ankit Srivastava, Marius Lazer, and Thomas Piccioli. Advised them on their project in CSCI 4440, Software Design and Documentation. Project title: "Power Generator Database for Simulating Policies and Investments." Fall 2010.

Liam Bowen, Joe Chrzanowski, Kevin Fort, and Alex Radocea. Advised them on their project in CSCI 4440, Software Design and Documentation. Project title: "Matching of Power Plants in Energy Information Administration and Environmental Protection Agency Databases." Fall 2010.

Daniel Corda (summer research project—Summer 2010), "An Attempt to Write Software to Combine the EIA and EPA Electric Generator Databases."

Savaknou Khouy (Undergraduate Research Program—Fall 2009), "Electricity Markets and Power Flow Studies"

Frank Tobia (senior original research project—Spring 2009), "Experimental Study of Intertemporal Discounting"

Anasha Cummings (Vasudha research project—Spring 2009), "Increasing Penetration of Intermittent Renewable Energy Sources into the US Electric Power System"

**REFEREE**

**Refereeing of papers**

*The Energy Journal*

*Energy Policy*

*European Transactions on Electrical Power*

*IEEE Transactions on Power Systems*

*International Journal of Energy Technology and Policy*

*International Journal of Industrial Organization*

*Journal of Economic Behavior and Organization*

*Resource and Energy Economics*

**Refereeing of grant proposals**

National Science Foundation

New York State Energy Research and Development Authority

## **Supervision of Individual Study Courses** (at Rensselaer Polytechnic Institute)

| Course code | Course name | Student | Term |
|---|---|---|---|
| ECON 4940 | Behavioral Economics Research | Frank Tobia | S 2009 |
| ECON 6940 | Behavioral Economics Research | Emily Schultz | S 2009 |
| ECON 4940 | Electricity Policy Independent Study | Savaknou Khouy | S 2010 |
| ECON 4940 | Electricity Policy Independent Study | Anna Josephson | S 2010 |
| ECON 4940 | Electricity Policy Independent Study | Cristina Vigil | S 2010 |
| ECON 2940 | Electricity Policy Independent Study | Saadia Safir | S 2010 |
| ECON 6940 | Electricity Policy Independent Study | Xiaohua Wu | S 2010 |
| ECON 6940 | Electricity Policy Independent Study | Damion Crichlow | S 2010 |
| ECON 6960 | Emissions Permit Trading | Veronica Wang | S 2010 |
| ECON 6940 | Electricity Policy Independent Study | Shreekanth Venkataraman | Su 2010 |
| ECON 6960 | RGGI Leakage Econometric Analysis | Andrew Kindle | S 2011 |
| ECON 6960 | Electricity Policy | Gregory Mahlum | S 2011 |
| ECON 6960 | Energy/Environmental Research | Andrew Kindle | F 2011 |
| ECON 6960 | Electricity Market Incentive Theory | Andrew Kindle | S 2012 |
| ECON 6960 | Estimating Generation Efficiency & Emissions Functions | Andrew Kindle | S 2012 |
| ECON 6960 | ARMA Forecasting of Generation Emission Functions | Andrew Kindle | F 2012 |
| ECON 6960 | RGGI Leakage Econometric Analysis II | Andrew Kindle | F 2012 |
| ECON 6960 | Power System & Emission Simulation for New York | Andrew Kindle | F 2012 |
| ECON 6990 | M.S. Thesis Research | Ellen Roybal | S 2012 |
| ECON 6960 | NY & TX Emission Forecasts | Andrew Kindle | S 2013 |
| ECON 6960 | Power System & Emission Simulation for New York II | Andrew Kindle | S 2013 |
| ECON 4940 | Seminar in Economics | Nomita Vazirani | S 2013 |
| ECON 6960 | RGGI Leakage Econometric Analysis III | Andrew Kindle | S 2013 |
| ECON 6960 | Environmental and Economic Simulation of Power Systems | Biao Mao | F 2013 |
| ECON 4940 | Economic and Environmental Modeling of Power Systems | Joel Trombley | F 2013 |
| ECSE 6990 | M.S. Thesis Research | Zamiyad Dar | F 2013 |
| ECON 9990 | Ph.D. Dissertation Research | Andrew Kindle | S 2014 |
| ECON 6960 | Environmental and Economic Simulation of Power Systems | Biao Mao | S 2014 |
| ECSE 6990 | M.S. Thesis Research | Zamiyad Dar | S 2014 |
| ECON 9990 | Ph.D. Dissertation Research | Andrew Kindle | S 2014 |
| ECON 6960 | Environmental and Economic Simulation of Power Systems | Biao Mao | S 2014 |
| ECSE 6990 | M.S. Thesis Research | Zamiyad Dar | S 2014 |
| ECON 9990 | Ph.D. Dissertation Research | Andrew Kindle | F 2014 |
| ECON 6960 | Economic and Environmental Dispatch of Power Systems | Biao Mao | F 2014 |
| ECON 6960 | Simulation of Electricity Policies | Biao Mao | F 2014 |
| ECSE 6990 | M.S. Thesis Research | Zamiyad Dar | F 2014 |

## PROFESSIONAL EXPERIENCE

**Resources for the Future**, Washington DC
*Fellow, October 2018-present*
*Visiting fellow, June 2014-September 2018*
*Center fellow, September 2016-September 2017*
*Gilbert F. White fellow, July 2013-June 2014*

**New York Independent System Operator**, Rensselaer, NY
*Member, Environmental Advisory Council, 2011-present*

**Rensselaer Polytechnic Institute**, Troy, NY
*Doctoral research advisor, January 2015-May 2017*
*Assistant professor, Department of Economics and Lally School of Management and Technology, July 2008-December 2014 (on fellowship leave July 2013-August 2014)*
*Interim graduate program director, Department of Economics, June 2009-June 2010*

**Cornell University**, Ithaca, NY
*Adjunct assistant professor of Applied Economics and Management, 2010-present*

**Professional roles during graduate studies at Cornell University:**
*Instructor, Spring 2008 and Spring 2007. Taught Cornell's 4000-level and master's-level environmental economics courses.*
*Head teaching assistant, William Schulze's "Behavioral Decision-Making for Managers," Fall 2002 and Spring 2005. Led team of 5 teaching assistants. Conducted 15 experiments, each designed to give the 60 students the opportunity to personally exhibit a decision-making anomaly. Course won College of Agricultural and Life Sciences 2002 innovative teaching award.*
*Teaching assistant, Gregory Poe's "Environmental and Resource Economics," Spring 2003.*

**The Maryland Public Interest Research Group (MaryPIRG)**, Baltimore, Annapolis, and DC
*Executive director and energy program coordinator, September 1999-August 2002*
- Worked with Maryland General Assembly, Public Service Commission, executive agencies, governor, congressional delegation, other non-governmental and industry organizations, and media.
- Co-led successful efforts to pass Maryland hybrid and electric vehicle tax credit (the first in the nation), appliance and equipment efficiency mandatory standards (later emulated by seven other states and now in federal law), Maryland renewable energy portfolio standard, Maryland energy efficiency and renewable energy tax incentives (later emulated in several other states), Maryland "green buildings" tax incentive program (first legislation in the nation to use LEED standards), and regulations for environmental labeling of electricity.
- Interviewed by or otherwise covered by *The Washington Post*, *The Baltimore Sun*, *The Washington Times*, *Baltimore* magazine, and most of Maryland's other newspapers, television stations, and radio stations.
- Managed the MaryPIRG and MaryPIRG Foundation staff, August 2000-August 2002.

**Tellus Institute**, Boston, MA
*Research associate, June 1998-September 1999*

- Helped the official consumer advocate agencies of Arizona, Colorado, Pennsylvania, Maine, and Nevada as well as the Public Service Commission staff of Delaware to develop their input to electric restructuring policy-making processes.
- Drafted official comments of National Association of State Utility Consumer Advocates on Federal Energy Regulatory Commission's Notice of Proposed Rulemaking on Regional Transmission Organizations.
- Addressed wide range of restructuring-related issues, with particular emphasis on stranded costs and benefits; market power; and shopping credits.
- Also dedicated significant attention to unbundling of services and rates; design of markets for generation and ancillary services; potential for retail electric choice to substantially increase overhead costs of service providers; divestiture and vertical de-integration; affiliate transaction rules; logical sequence and timetable of restructuring actions; effect of rate design on income distribution; securitization; negotiated rate freezes and reductions; treatment of must-run generation; slamming; regional transmission organizations; and environmental labeling and emissions tracking.

**US renewable energy industry associations** (including American Wind Energy Association, US Export Council for Renewable Energy, and Geothermal Energy Ass'n), Washington DC
*Research associate, February 1996-June 1998*

- Researched and wrote about renewable energy for industry members, policymakers, and the public. Topics included technology status, externalities, resource distribution, applications, project examples, cost, typical financing arrangements, project development considerations, extent of utilization, and developments of interest to industry.

**The Socio-Environmental Development Foundation** (Conservation International partner), Ecuador
*Researcher, June-August 1994*

- Investigated and reported on feasibility, strategies, and impacts of commercializing sustainably extractable *Castilla* latex from biodiverse forest in Western Ecuador.

**Overseas Private Investment Corporation (OPIC)**, Washington, DC and Caracas
*Intern, June-August 1993*

- Researched investment outlook in selected sectors of four Latin American economies.
- Contributed to design of OPIC's first environmental investment mission.

## LANGUAGES

English (native)
Spanish (fully proficient)
Portuguese (reading and imperfect conversation and writing)
Nepali (rudimentary conversation)