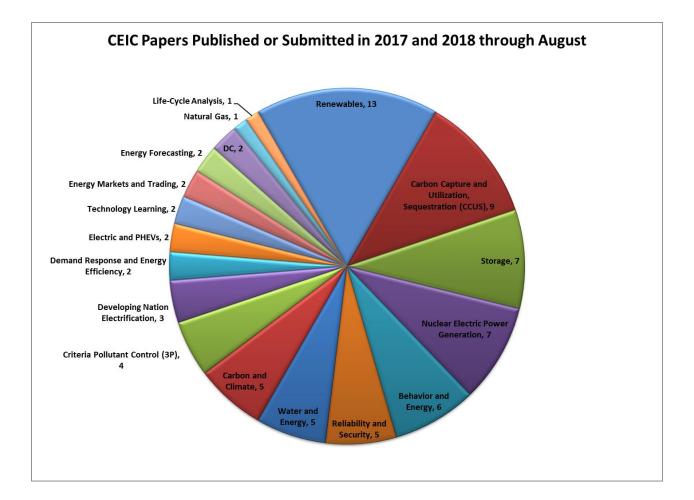


CARNEGIE MELLON ELECTRICITY INDUSTRY CENTER

AN INTERDISCIPLINARY CENTER ADMINISTERED BY THE TEPPER SCHOOL OF BUSINESS AND THE CARNEGIE MELLON COLLEGE OF ENGINEERING.

Peer-Reviewed Research Papers in 2017 and 2018



Published Papers:

Abanades, J.C., E.S. Rubin, M. Mazzotti, and H.J. Herzog, "On the climate change mitigation potential of CO2 conversion to fuels." *Energy and Environmental Science*. 2017. 10: 2491-2499.

Abdulla, A., M.J. Ford, M.G. Morgan, and D.G. Victor, "A retrospective analysis of funding and focus in US advanced fission innovation." *Environmental Research Letters*. 2017. 12 (8): 084016.

Anderson, J., D. Rode, H. Zhai, and P. Fischbeck, "Will We Always Have Paris? CO2 Reduction without the Clean Power Plan". *Environmental Science & Technology*. 2018. 52 (5): 2432-2433.

Apt, J., "Forum: Climate Engineering." Issues in Science and Technology, 2017. 33(4): 5-8.

Baik, S., A.L. Davis, and M.G. Morgan, "Assessing the Cost of Large-scale Power Outages to Residential Customers." *Risk Analysis*. 2018. 38 (2), 283-296.

Baik, S., M.G. Morgan, and A.L. Davis, "Providing Limited Local Electric Service During a Major Grid Outage: A First Assessment Based on Customer Willingness to Pay." *Risk Analysis*. 2018. 38 (2), 272-282.

Bogert, K.J. and E.S. Rubin, "Oxy-combustion Carbon Capture for Pulverized Coal in the Integrated Environmental Control Model." *Energy Procedia*. 2017. 114: 522-529.

Canfield, C. W. Bruine de Bruin, and G. Wong-Parodi, "Perceptions of electricity-use communications: effects of information, format, and individual differences." *Journal of Risk Research*. 2017. 20 (9): 1132-1153.

Chan, H.R., B.A. Chupp, M.L. Cropper, and N.Z. Muller, "The impact of trading on the costs and benefits of the Acid Rain Program." *Journal of Environmental Economics and Management*. 2018. 88: 180-209.

Ciez, R.E. and J.F. Whitacre, "Comparison between cylindrical and prismatic lithium-ion cell costs using a process based cost model." *Journal of Power Sources*. 2017. 340: 273-281.

Clack, C. T. M., S.A. Qvist, J. Apt, M. Bazilian, A,R. Brandt, K. Caldeira, S.J. Davis, V. Diakov, M.A. Handschy, P.D. H. Hines, P. Jaramillo, D.M. Kammenm, J.C.S. Long, M.G. Morgan, A. Reed, V. Sivaram, J. Sweeney, G.R. Tynan, D.G. Victor, J.P. Weyant, and J.F. Whitacre, "Evaluation of a proposal for reliable low-cost grid power with 100% wind, water, and solar." *Proceedings of the National Academy of Sciences of the United States of America*, 2017. 114(26): 6722-6727.

Craig, M.T., P. Jaramillo, B.M. Hodge, N.J. Williams, and E. Severnini, "A retrospective analysis of the market price response to distributed photovoltaic generation in California." *Energy Policy.* 2018. 121: 394-403.

Craig, M.T., P. Jaramillo, and B.M. Hodge, "Carbon dioxide emissions effects of grid-scale electricity storage in a decarbonizing power system," *Environmental Research Letters* 13 (1): 014004.

Craig, M.T., P. Jaramillo, H. Zhai, and K. Klima, "The Economic Merits of Flexible Carbon Capture and Sequestration as a Compliance Strategy with the Clean Power Plan." *Environmental Science & Technology*. 2017. 51 (3): 1102-1109.

Craig, M.T., H. Zhai, P. Jaramillo, and K. Klima, "Trade-offs in cost and emission reductions between flexible and normal carbon capture and sequestration under carbon dioxide emission constraints." *International Journal of Greenhouse Gas Control.* 2017. 66: 25-34.

Davis, A.L., G. Wong-Parodi, and T. Krishnamurti, "Neither a borrower nor a lender be: Beyond cost in energy efficiency decision-making among office buildings in the United States." *Energy Research and Social Science*. 2019. 47:37-45.

Dryden, R., M.G. Morgan, A. Bostrom, W. Bruine de Burin, "Public Perceptions of How Long Air Pollution and Carbon Dioxide Remain in the Atmosphere." *Risk Analysis*. 2017. doi:10.1111/risa.12856.

Faria, F.A.M. and P. Jaramillo, "The future of power generation in Brazil: An analysis of alternatives to Amazonian hydropower development." *Energy for Sustainable Development*. 2017. 41: 24-35.

Faria, F.A.M., A. Davis, E. Severnini, and P. Jaramillo, "The local socio-economic impacts of large hydropower plant development in a developing country." *Energy Economics*. 2017. 67: 533-544.

Farquharson, D., P. Jaramillo, G. Schivley, K. Klima, D. Carlson, and C. Samaras. "Beyond global warming potential: a comparative application of climate impact metrics for the life cycle assessment of coal and natural gas based electricity." *Journal of Industrial Ecology*. 2017. 21 (4): 857-873.

Fisher, M., J. Whitacre, and J. Apt, "A Simple Metric for Predicting Revenue from Electric Peak-Shaving and Optimal Battery Sizing." *Energy Technology*, 2018. **6**(4): 649-657.

Fisher, M.J. and J. Apt, "Emissions and Economics of Behind-the Meter Electricity Storage". *Environmental Science & Technology*, 2017. 51(3): 1094-1101.

Fisher, M.J., F. Sowell, and J. Apt, "The economics of commercial demand response for spinning reserve." *Energy Systems*, 2017. DOI: 10.1007/s12667-017-0236-x.

Ford, M.J., A. Abdulla, M. G. Morgan, and D. G. Victor, "Expert assessments of the state of U.S. advanced fission innovation." *Energy Policy*, 2017 18: 194-200.

Ford, M.J., A. Abdulla, and M. G. Morgan, "Evaluating the Cost, Safety, and Proliferation Risks of Small Floating Nuclear Reactors." *Risk Analysis*. 2017. DOI: 10.1111/risa.12756

Ford, M.J., A. Abdulla, and M. G. Morgan, "Nuclear power needs leadership, but not from the military." *Issues in Science and Technology*. 2018. 34 (4): 67-72.

Freeman, G, J. Apt, and M. Dworkin, "The Natural Gas Grid Needs Better Monitoring". *Issues in Science and Technology*, 2018. **34**(4): 79-84.

Gingerich, D.B. and M. Mauter, "Retrofitting the Regulated Power Plant: Optimizing Energy Allocation to Electricity Generation, Water Treatment, and Carbon Capture Processes at Coal-Fired Generating Facilities." *ACS Sustainable Chemistry & Engineering*. 2018. 6 (2): 2694-2703.

Gingerich, D.B. and M. Mauter, "Air emission reduction benefits of biogas electricity generation at municipal wastewater treatment plants." *Environmental Science & Technology*. 2018. 52 (3): 1633-1643.

Gingerich, D.B., E.J. Grol, and M. Mauter, "Fundamental challenges and engineering opportunities in flue gas desulfurization wastewater treatment at coal fired power plants." *Environmental Science: Water Research & Technology*. 2018. 4: 909-925.

Gingerich, D.B., X. Sun, A.P. Behrer, I.M.L. Azevedo, and M. Mauter, "Spatially resolved airwater emissions tradeoffs improve regulatory impact analyses for electricity generation." *Proceedings of the National Academy of Sciences of the United States*. 2017. 114 (8): 1862-1867.

Glasgo, B., I.M.L. Azevedo and C.T. Hendrickson, "Expert assessments on the future of direct current in buildings." *Environmental Research Letters*. 2018. 13(7): 074004.

Glasgo, B., C.T. Hendrickson, and I.M.L. Azevedo, "Assessing the value of information in residential building simulation: Comparing simulated and actual building loads at the circuit level." *Applied Energy*. 2017. 203: 348-363.

Glasgo, B., C.T. Hendrickson, and I.M.L. Azevedo, "Using advanced metering infrastructure to characterize residential energy use." *The Electricity Journal*. 2017. 30 (3): 64-70.

Handschy, M.A., S. Rose and J. Apt, "Is It Always Windy Somewhere? Occurrence of Low-Wind-Power Events over Large Areas". *Renewable Energy*, 2017. 101: 1124-1130.

He, G., Q. Chen, P. Moutis, S. Kar, and J.F. Whitacre, "An intertemporal decision framework for electrochemical energy storage management." *Nature Energy*. 2018. 3 (5): 404.

Heuberger, C.F., E.S. Rubin, I. Staffell, N. Shah, and N. MacDowell, "Power capacity expansion planning considering endogenous technology cost learning." *Applied Energy*. 2017. 204: 831-845.

Hittinger, E. and I.M.L. Azevedo, "Estimating the Quantity of Wind and Solar Required To Displace Storage-Induced Emissions." *Environmental Science & Technology*. 2017. 51 (21): 12988-12997.

Hu, B. and H. Zhai, "The cost of carbon capture and storage for coal-fired power plants in China." *International Journal of Greenhouse Gas Control*. 2017. 65: 23-31.

Kaack, L.H., J. Apt, M.G. Morgan, and P. McSharry, "Empirical Prediction Intervals Improve Energy Forecasting." *Proceedings of the National Academy of Sciences of the United States of America*. 2017. 114(33): 8752-8757.

Kaack, L.H., P. Vaishnav, M.G. Morgan, I.M.L. Azevedo, and S. Rai, "Decarbonizing intraregional freight systems with a focus on modal shift", *Environmental Research Letters*. 2018. 13(2).

Klima, K., J. Apt, M. Bandi, P. Happy, C. Loutan, and R. Young, "Geographic smoothing of solar photovoltaic electric power production in the western USA." In press at *Journal of Renewable and Sustainable Energy*.

Lam, L.T., L. Bransetter, and I.M.L. Azevedo. "A sunny future: expert elicitation of China's solar photovoltaic technologies." *Environmental Research Letters*. 2018. 13 (3): 034038.

Lam, L.T., L. Bransetter, and I.M.L. Azevedo. "China's wind industry: Leading in deployment, lagging in innovation." *Energy Policy*. 2017. 106: 588-599.

Lamy, J.V. and I.M.L. Azevedo, "Do tidal stream energy projects offer more value than offshore wind farms? A case study in the United Kingdom." *Energy Policy*. 2018. 113: 28-40.

Lamy, J.V., W. Bruine de Bruin, I.M.L. Azevedo, and M.G. Morgan. "Perceptions of wind energy projects in two coastal Massachusetts communities.". *The Electricity Journal*. 2017. 30 (7): 31-42.

Lesic, V., W. Bruine de Bruin, M.C. Davis, T. Krishnamurti, and I.M.L. Azevedo, "Consumers' perceptions of energy use and energy savings: A literature review." *Environmental Research Letters*. 2018. 13 (3): 033004.

Lim-Wavde, K., H. Zhai, R.J. Kauffman, and E.S. Rubin. "Assessing carbon pollution standards: Electric power generation pathways and their water impacts." *Energy Policy*. 2017. 120: 714-733.

Mantripragada, H.C. and E.S. Rubin, "Chemical Looping for Pre-combustion and Post-combustion CO2 Capture." *Energy Procedia*. 2016. 114: 6403-6410.

Morgan, M.G., A, Abdulla, M.J. Ford, and M. Rath, "US nuclear power: The vanishing low-carbon wedge." *Proceedings of the US National Academy of Sciences*. 2018. https://doi.org/10.1073/pnas.1804655115

Muller, N.Z. and P.A. Ruud, "What forces dictate the design of pollution monitoring networks?" *Environmental Modeling & Assessment*. 2018. 23 (1): 1-14.

Murphy, S., J. Apt, J. Moura, and F. Sowell, "Resource adequacy risks to the bulk power system in North America." *Applied Energy*, 2018. **212**: 1360-1376.

Nadarajah, S. and N. Secomandi, "Merchant energy trading in a network." *Operations Research*. 2018. https://doi.org/10.1287/opre.2018.1732

Nadarajah, S., F. Margot, and N. Secomandi, "Comparison of least squares Monte Carlo methods with applications to energy real options." *European Journal of Operations Research*. 2017. 256 (1): 196-204.

Peña, I., I.M.L. Azevedo, and L.A.F.M. Ferreira, "Lessons from wind policy in Portugal." *Energy Policy*. 2017. 103: 193-202.

Paolella, D.A., C.W. Tessum, P.J. Adams, J.S. Apte, S. Chambliss, J. Hill, N.Z. Muller, and J.D. Marshall, "Effect of Model Spatial Resolution on Estimates of Fine Particulate Matter Exposure and Exposure Disparities in the United States." *Environmental Science & Technology Letters* 2018 5 (7): 436-441.

Prata, R., P.M.S. Carvalho, and I.M.L. Azevedo, "Distributional costs of wind energy production in Portugal under the liberalized Iberian market regime." *Energy Policy*. 2018. 113: 500-512.

Prata, R., P.M.S. Carvalho, and I.M.L. Azevedo, "Wind energy production variations in continental Portugal: an analysis of the combined effects of spot market price and feed-in tariff costs." *CIRED-Open Access Proceedings Journal*. 2017. 1: 2952-2955.

Roth, M.B. and P. Jaramillo. "Going nuclear for climate mitigation: An analysis of the cost effectiveness of preserving existing US nuclear power plants as a carbon avoidance strategy." *Energy.* 2017. 131: 67-77.

Roohani, Y.H., A.A. Roy, J. Heo, A.L. Robinson, and P.J. Adams. "Impact of natural gas development in the Marcellus and Utica shales on regional ozone and fine particulate matter levels." *Atmospheric Environment*. 2017. 155: 11-20.

Sakti, A., I.M.L. Azevedo, E.R.H. Fuchs, J.J. Michalek, K.G. Gallagher, and J.F. Whitacre, "Consistency and robustness of forecasting for emerging technologies: The case of Li-ion batteries for electric vehicles." *Energy Policy*. 2017. 106: 415-426.

Sergi, B., A. Davis, and I. Azevedo, "The effect of providing climate and health information on support for alternative electricity portfolios." 2018. *Environmental Research Letters* 13 (2): 024026.

Schivley, G., I.M.L. Azevedo, and C. Samaras, "Assessing the evolution of power sector carbon intensity in the United States." 2018. *Environmental Research Letters* 13(6): 064018.

Sherwin, E.D., M. Henrion, and I.M.L. Azevedo, "Estimation of the year-on-year volatility and the unpredictability of the United States energy system." *Nature Energy*. 2018. 3 (4): 341.

Thind, M.P.S., E.J. Wilson, I.M.L. Azevedo, and J.D. Marshall, "Marginal Emissions Factors for Electricity Generation in the Midcontinent ISO." *Environmental Science & Technology*. 2017. 51 (24): 14445-14452.

Trutnevyte, E. and I.M.L. Azevedo, "Induced seismicity hazard and risk by enhanced geothermal systems: an expert elicitation approach." *Environmental Research Letters*. 2018. 13 (3): 034004

Vaishnav, P., N. Horner, and I.M.L. Azevedo, "Where have the benefits of rooftop solar photovoltaic generation exceeded the cost?" *Environmental Research Letters*. 2017. 12: 094015.

Volken, S., G. Wong-Parodi, and E. Trutnevyte, "Public awareness and perception of environmental, health and safety risks to electricity generation: an explorative interview study in Switzerland." *Journal of Risk Research*. 2017. DOI: 10.1080/13669877.2017.1391320

Wender, B., M.G. Morgan, J.K. Holmes, "Enhancing the Resilience of Electricity Systems." *Engineering*. 2017. 3 (5): 580-582.

Williams, N.J., P. Jaramillo, and J. Taneja, "An investment risk assessment of microgrid utilities for rural electrification using the stochastic techno-economic microgrid model: A case study in Rwanda." *Energy for Sustainable Development*. 2018. 42: 87-96.

Yuksel, T., S. Litster, V. Viswanathan, J.J. Michalek, "Plug-in hybrid electric vehicle LiFePO 4 battery life implications of thermal management, driving conditions, and regional climate." *Journal of Power Sources*. 2017. 338: 49-64.

Zhai, H. and E.S. Rubin, "Systems Analysis of Physical Absorption of CO2 in Ionic Liquids for Pre-Combustion Carbon Capture." *Environmental Science & Technology*. 2018. 52: 4996-5004.

Zhai, H. and E.S. Rubin, "Technical and Economic Assessments of Ionic Liquids for Pre-Combustion CO2 Capture at IGCC Power Plants." *Energy Procedia*. 2017. 114: 2166-2172.

Papers recently submitted for peer review:

Clay, K. and L. Kiesling, "Innovation, Interconnection, and Institutions: Evolving Electric Power Systems in the Early 20th Century."

Fisher, M., J. Apt, and J. Whitacre, "Flow Batteries are Uncompetitive in the Commercial and Industrial Market."

Kefford, B., D. Schmeda-Lopez, M. Stringer, C. Greig, S. Smart, M. Small, and G. Wong-Parodi. "Identifying regionally dependent barriers in the Carbon Capture and Storage industry"

Rath, M. and M. G. Morgan, "Assessment of a Hybrid System that Uses Small Modular Reactors (SMRs) to Back Up Intermittent Renewables and Desalinate Water."

Reed, L., M.G. Morgan, P. Vaishnav and D.E. Armanios "HVDC conversion may be a costeffective way to increase the transmission capacity of existing corridors."

Ph.D. Dissertations Completed in 2017 and 2018

Sunhee Baik, An Improved Method to Assess the Value of Assuring Limited Local Electric Service in the Event of Major Grid Outages. 2018.

Travis Carless, Framing a New Nuclear Renaissance Through Environmental Competitiveness, Community Characteristics, and Cost Mitigation Through Passive Safety. 2018.

Rebecca Ciez, Battery energy storage for maturing markets: performance, cost, perceptions, and environmental impacts. 2018.

Michael Craig, Economic and Environmental Costs, Benefits, and Trade-offs of Low-Carbon Technologies in the Electric Power Sector. 2017.

Michael Fisher, Integrating demand-side resources into the electric grid: Economic and environmental considerations. 2017.

Michael Ford, Studies in nuclear power: Low risk and low carbon. 2017.

Nichole Hanus, An Engineering and Behavioral Sciences Approach to Understand and Inform Energy Efficiency and Renewable Energy Decision-Making. 2018.

Richard Huntsinger, Evaluating Forecasting Performance in the Context of Process-Level Decisions: Methods, Computation Platform, and Studies in Residential Electricity Demand Estimation. 2017.

Long Lam, Innovation in China's renewable energy industry. 2017.

Manuel Loureiro, Transmission and interconnection planning in power systems: Contributions to investment under uncertainty and cross-border cost allocation. 2017.

Amritanshu Pandey, Robust Power Flow and Three-phase Power Flow using Equivalent Circuit Formulation with Circuit Simulation Methods, 2018.

Jose Fernando Prada, Ensuring the Reliable Operation of the Power Grid: State-Based and Distributed Approaches. 2017.

Chin Yen Tee, Market design for the future electricity grid: Modeling tools and investment case studies. 2017.

Nathaniel Williams, Microgrid utilities for rural electrifications in East Africa: Challenges and opportunities. 2017.