

Patrick Luckow, Senior Associate

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PROFESSIONAL EXPERIENCE

Synapse Energy Economics Inc., Cambridge, MA. *Senior Associate*, 2015 – present, *Associate*, May 2012 – June 2015.

Provides consulting services, conducts research, and performs analysis of energy investments. Calibrates, runs, and modifies industry-standard economic models to evaluate long-term energy plans, and the environmental and economic impacts of policy/regulatory initiatives.

Joint Global Change Research Institute, College Park, MD. *Scientist*, 2009 – 2011.

Evaluated the long-term implications of potential climate policies, both internationally and in the US, across a range of energy and electricity models. Modeled large-scale biomass use in the global energy system. Led a team studying global wind energy resources and their interaction in the Institute's integrated assessment model. Utilized updated global wind supply curves to help understand both onshore and offshore wind deployment, and issues associated with transmission requirements, intermittency, and technology costs.

DaimlerChrysler, Auburn Hills, MI. *Stress Lab & Durability Development Intern*, 2007.

Completed load and vibration data acquisition and analysis on various Chrysler vehicles, and contributed to the development of an improved generic body vibration profile.

Northrop Grumman, Rolling Meadows, IL. *Defensive Systems Division Co-op*, 2005 – 2007.

Designed new enclosures and mounting structures for electronic components, silenced existing enclosures, and conducted thermal testing of complete systems.

EDUCATION

University of Maryland, College Park, MD
Master of Science in Mechanical Engineering, 2009.

Northwestern University, Evanston, IL
Bachelor of Science in Mechanical Engineering, 2007.

PUBLICATIONS

Knight, P., P. Luckow, B. Biewald, A. Horowitz, A. Allison, F. Ackerman. 2017. *New England's Shrinking Need for Natural Gas: An analysis of policy impacts on natural gas use in New England's electric sector*. Synapse Energy Economics for the Connecticut Fund for the Environment, Consumers for Sensible

Energy, Mass Energy Consumers Alliance, Pipe Line Awareness Network for the Northeast, Sierra Club Connecticut, and Sierra Club Massachusetts.

Fagan, B., A. Napoleon, S. Fields, P. Luckow. 2017. *Clean Energy for New York: Replacement Energy and Capacity Resources for the Indian Point Energy Center Under New York Clean Energy Standard (CES)*. Synapse Energy Economics for Riverkeeper and Natural Resources Defense Council.

Fisher, J., P. Luckow, A. Horowitz, T. Comings, A. Allison, E.A. Stanton, S. Jackson, K. Takahashi. 2016. *Michigan Compliance Assessment for the Clean Power Plan: MPSC/MDEQ EPA 111(d) Impact Analysis*. Prepared for Michigan Public Service Commission, Michigan Department of Environmental Quality, and Michigan Agency for Energy.

Buonocore, J. J., P. Luckow, J. Fisher, W. Kempton, J. I. Levy. 2016. "Health and climate benefits of offshore wind facilities in the Mid-Atlantic United States." *Environmental Research Letters*, 11 (2016) 074019. doi: 10.1088/1748-9326/11/7/074019

Fisher, J., N. Santen, P. Luckow, F. De Sisternes, T. Levin, A. Botterud. 2016. *A Guide to Clean Power Plan Modeling Tools: Analytical Approaches for State Plan CO₂ Performance Projections*. Prepared by Synapse Energy Economics and Argonne National Laboratory.

Woolf, T., A. Napoleon, P. Luckow, W. Ong, K. Takahashi. 2016. *Aiming Higher: Realizing the Full Potential of Cost-Effective Energy Efficiency in New York*. Synapse Energy Economics for Natural Resources Defense Council, E4TheFuture, CLEAResult, Lime Energy, Association for Energy Affordability, and Alliance for Clean Energy New York.

Jackson, S., P. Luckow, E.A. Stanton, A. Horowitz, P. Peterson, T. Comings, J. Daniel, and T. Vitolo. 2016. *Reimagining Brayton Point: A Guide to Assessing Reuse Options for the Somerset Community*. Prepared by Synapse Energy Economics for Coalition for Clean Air South Coast, Clean Water Action, and Toxics Action Center.

Luckow, P., E.A. Stanton, S. Fields, W. Ong, B. Biewald, S. Jackson, J. Fisher. 2016. *Spring 2016 National Carbon Dioxide Price Forecast*. Synapse Energy Economics.

Vitolo, T., A. Horowitz, P. Luckow, and N.R. Santen. 2015. *Meeting Maryland's RPS*. Synapse Energy Economics for the Maryland Climate Coalition.

Fisher, J., P. Luckow, N. R. Santen. 2015. *Review of the Use of the System Optimizer Model in PacifiCorp's 2015 IRP*. Synapse Energy Economics for Sierra Club, Western Clean Energy Campaign, Powder River Basin Resource Council, Utah Clean Energy, and Idaho Conservation League.

Buonocore, J. J., P. Luckow, G. Norris, J. D. Spengler, B. Biewald, J. Fisher, J. I. Levy. 2015. "Health and climate benefits of different energy-efficiency and renewable energy choices." *Nature Climate Change*, August 2015: doi:10.1038/nclimate2771.

Luckow, P., T. Vitolo, J. Daniel. 2015. *A Solved Problem: Existing Measures Provide Low-Cost Wind and Solar Integration*. Synapse Energy Economics.

Fields, S., P. Luckow, T. Vitolo. 2015. *Clean Energy Future Technical Review*. Synapse Energy Economics.

Vitolo, T., P. Luckow, S. Fields, P. Knight, B. Biewald, E. A. Stanton. 2015. *Lower Electric Costs in a Low-Emission Future*. Synapse Energy Economics.

Biewald, B., J. Daniel, J. Fisher, P. Luckow, A. Napoleon, N. R. Santen, K. Takahashi. 2015. *Air Emissions Displacement by Energy Efficiency and Renewable Energy*. Synapse Energy Economics.

Luckow, P., B. Fagan, S. Fields, M. Whited. 2015. *Technical and Institutional Barriers to the Expansion of Wind and Solar Energy*. Synapse Energy Economics for Citizens' Climate Lobby.

Luckow, P., E. A. Stanton, S. Fields, B. Biewald, S. Jackson, J. Fisher, R. Wilson. 2015. *2015 Carbon Dioxide Price Forecast*. Synapse Energy Economics.

Breslow, M., S. Hamel, P. Luckow, S. Nystrom. 2014. *Analysis of a Carbon Fee or Tax as a Mechanism to Reduce GHG Emissions in Massachusetts*. Prepared for the Massachusetts Department of Energy Resources.

Nystrom, S., P. Luckow. 2014. *The Economic, Climate, Fiscal, Power, and Demographic Impact of a National Fee-and-Dividend Carbon Tax*. Regional Economic Models, Inc. and Synapse Energy Economics for Citizens' Climate Lobby.

Luckow, P., J. Daniel, S. Fields, E. A. Stanton, B. Biewald. 2014. "CO₂ Price Forecast: Planning for Future Environmental Regulations." *EM Magazine*, June 2014, 57-59.

Luckow, P., E. A. Stanton, B. Biewald, S. Fields, S. Jackson, J. Fisher, F. Ackerman. 2014. *CO₂ Price Report, Spring 2014: Includes 2013 CO₂ Price Forecast*. Synapse Energy Economics.

Fagan, R., T. Vitolo, P. Luckow. 2014. *Indian Point Energy Center: Effects of the Implementation of Closed-Cycle Cooling on New York Emissions and Reliability*. Synapse Energy Economics for Riverkeeper.

Rudkevich, A., R. Hornby, P. Luckow. 2014. *Audit of Port Hawkesbury Paper Load Retention Tariff*. Newton Energy Group and Synapse Energy Economics for the Nova Scotia Utility and Review Board.

Luckow, P., E. A. Stanton, B. Biewald, J. Fisher, F. Ackerman, E. Hausman. 2013. *2013 Carbon Dioxide Price Forecast*. Synapse Energy Economics.

Hornby, R., P. Chernick, D. White, J. Rosenkranz, R. Denhardt, E. A. Stanton, J. Gifford, B. Grace, M. Chang, P. Luckow, T. Vitolo, P. Knight, B. Griffiths, B. Biewald. 2013. *Avoided Energy Supply Costs in New England: 2013 Report*. Synapse Energy Economics for Avoided-Energy-Supply-Component (AESC) Study Group.

Ackerman, F., T. Comings, P. Luckow. 2013. *A Review of Consumer Benefits from a Corporate Average Fuel Economy (CAFE) Standards*. Synapse Energy Economics for Consumers Union.

Fagan, R., P. Luckow, D. White, R. Wilson. 2013. *The Net Benefits of Increased Wind Power in PJM*. Synapse Energy Economics for Energy Future Coalition.

Wilson, R., P. Luckow, B. Biewald, F. Ackerman, E. Hausman. 2012. *2012 Carbon Dioxide Price Forecast*. Synapse Energy Economics.

Biewald, B., T. Vitolo, P. Luckow. 2012. *Comments Regarding KCP&L's 2012 IRP Filing*. Sierra Club and Synapse Energy Economics.

Zhou, Y., P. Luckow, S.J. Smith, and L.E. Clarke. 2012. "Evaluation of Global Onshore Wind Energy Potential and Generation Costs." *Environmental Science & Technology* 46 (14):7857–7864, doi:10.1021/es204706m.

Dooley, J., P. Luckow, M.A. Wise. 2012. *Algal Biodiesel Production in GCAM: Initial Parameterization and Discussion of Potential Model Development Areas*. College Park, MD: Joint Global Change Research Institute and Pacific Northwest National Laboratory.

Edmonds, J., P. Luckow, K. Calvin, M.A. Wise, J.J. Dooley, P. Kyle, S. Kim, P. Patel, and L.E. Clarke. 2013. "Can radiative forcing be limited to 2.6 Wm⁻² without negative emissions from bioenergy AND CO₂ capture and storage?" *Climatic Change* 118 (1): 29–43, doi:10.1007/s10584-012-0678-z.

Luckow, P., M.A. Wise, J.J. Dooley, S.H. Kim. 2010. "Large-scale utilization of biomass energy and carbon dioxide capture and storage in the transport and electricity sectors under stringent CO₂ concentration limit scenarios." *International Journal of Greenhouse Gas Control* 4 (5): 865–877, doi:10.1016/j.ijggc.2010.06.002.

Luckow, P., M.A. Wise, J.J. Dooley. 2013. "Deployment of CCS Technologies across the Load Curve for a Competitive Electricity Market as a Function of CO₂ Emissions Permit Prices." Paper presentation at the 10th International Conference on Greenhouse Gas Control Technologies in Amsterdam, September 19 – 23, 2010.

Luckow, P., A. Bar-Cohen, P. Rodgers, and J. Cevallos. 2010. "Energy Efficient Polymers for Gas-Liquid Heat Exchangers" *Journal of Energy Resources Technology* 132 (2): 021001, doi:10.1115/1.4001568.

Luckow, P., A. Bar-Cohen, and P. Rodgers. 2009. "Minimum Mass Polymer Seawater Heat Exchanger for LNG Applications." *Journal of Thermal Science and Engineering Applications* 1 (3): 031009, doi:10.1115/1.4001239.

Luckow, P., A. Bar-Cohen, P. Rodgers, and J. Cevallos. 2008. "Energy Efficient Polymers for Gas-Liquid Heat Exchangers." Presentation at the ASME 2nd International Conference on Energy Sustainability in Jacksonville, FL, August 10 – 14, 2008.

TESTIMONY

New Orleans City Council (Docket No. UD-16-02): Testimony on Entergy New Orleans Application for Approval to Construct New Orleans Power Station. January 2017.

California Public Utilities Commission (Docket No. A.15-04-012): Testimony examining San Diego Gas & Electric's Marginal Energy Costs and LOLE Allocation among TOU Periods. Jointly with Bob Fagan. On behalf of the California Office of Ratepayer Advocate. June 2016.

Arizona Corporation Commission (Docket E-01933A-15-0322/0239): Direct testimony regarding Tucson Electric Power Company's plans for the San Juan Generation Station Unit 1. On behalf of Sierra Club. June 3, 2016.

New Mexico Public Service Company (Case 13-00390-UT): Testimony reviewing Strategist modeling of Public Service Company of New Mexico in petition to acquire San Juan Generation Station Unit 4 and Palo Verde 3 as replacement resources for abandonment of San Juan Units 2 and 3. On behalf of New Energy Economy. September 25, 2015.

California Public Utilities Commission (Docket No. A.14-11-014): Testimony examining Pacific Gas and Electric's Marginal Energy Costs and LOLE Allocation among TOU Periods. On behalf of the California Office of Ratepayer Advocate. May 1, 2015.

California Public Utilities Commission (Docket No. A.14-01-027): Testimony examining San Diego Gas & Electric's proposal to change time-of-use periods in its application for authority to update its electric rate design. On behalf of the California Office of Ratepayer Advocate. November 14, 2014.

California Public Utilities Commission (Docket No. R.12-06-013): Rebuttal testimony regarding the relationship between California investor-owned utilities hourly load profiles under a time-of-use pricing and GHG emissions in the WECC regions in the Order Instituting Rulemaking on the Commission's Own Motion to Conduct a Comprehensive Examination of Investor Owned Electric Utilities' Residential Rate Structures, the Transition to Time Varying and Dynamic Rates, and Other Statutory Obligations. On behalf of the California Office of Ratepayer Advocate. October 17, 2014.

California Public Utilities Commission (Docket No. R.13-12-010): Direct and reply testimony on Phase 1a modeling scenarios in the Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans. On behalf of the California Office of Ratepayer Advocate. August 13, 2014 and October 22, 2014.

Hawaii Public Utilities Commission (Docket No. 2012-0185): Direct testimony and exhibits regarding the proposed Aina Koa Pono Biofuel Project. On behalf of the State of Hawaii Division of Consumer Advocacy. March 2013.

Resume dated May 2017