

Patrick Knight, Senior Principal

Synapse Energy Economics | 485 Massachusetts Avenue, Suite 3 | Cambridge, MA 02139 | 617-453-7051
pknight@synapse-energy.com

PROFESSIONAL EXPERIENCE

Synapse Energy Economics, Inc., Cambridge, MA. *Senior Principal*, May 2022 – Present *Principal Associate*, 2018 – May 2022, *Senior Associate*, 2016 – 2018, *Associate*, 2013 – 2016, *Research Associate*, 2010 – 2013.

- Performs consulting, conducts research and modeling, and writes reports on issues including: economic technologies and policies, air emissions of electricity generation, consumer advocacy, costs and benefits of energy efficiency programs and measures, and environmental compliance and technology strategy within the energy industry.
- Co-developer of the Avoided Emissions and Generation Tool (AVERT), an open-access tool built for U.S. EPA by Synapse to estimate the hourly emissions and generation benefits of energy efficiency and renewable energy policies and programs
- Lead developer of the Coal Asset Valuation Tool (CAVT), a spreadsheet-based database and model that determines the future economic viability of coal units
- Lead developer of the EV-REDI (Electric Vehicle Regional Emissions and Demand Impacts) tool, a spreadsheet tool that models multiple impacts of transportation electrification for individual states
- Lead developer of the Multi-Sector Emissions Model (M-SEM), a spreadsheet-based database that evaluates historical and future energy use and emissions by state, sector, and fuel type
- Lead developer of the Clean Power Plan Planning Tool (CP3T), an Excel-based spreadsheet tool for performing first-pass planning of statewide compliance with EPA's Clean Power Plan

New Ecology, Inc., Boston, MA. *Associate*, 2009.

- Wrote reports for project managers and clients on how to economically make green energy improvements for low-income housing projects.
- Designed content, tested programming, and wrote business presentations for WegoWise, an in-house utility tracking and management software system.
- Prepared documentation for LEED Credits and other green certification programs.

PROFESSIONAL ACTIVITIES

Boston College Energy & Environment Alumni Network Co-Chair, Chestnut Hill, MA. 2017 – 2023.

Assists in drafting semi-annual newsletter, organizes student and alumni events on energy and environmental topics.

Beyond Solar Energy – Exploring Urban Renewable Energy Sources in Boston Field Project, Medford, MA. Spring 2009.

Studied the efficacy and viability of urban wind and biomass generators in conjunction with Boston's Department of Energy. Interviewed wind power stakeholders in the public, private, and nonprofit sectors and created a final report and presentation.

Solar Decathlon Team – Tufts University / Boston Architectural College, Medford, MA. Fall 2008 – Fall 2009.

Developed a web-based analytic software tool used for finding the cost and payback time for solar panels in any location in the United States based on costs, rebates, and solar input. Aided in the research and planning of a zero-energy house that participated in the National Solar Decathlon competition in Washington, DC. Researched regulations and incentives that would help to make a zero-energy house affordable and would allow it to be sited in Boston. Designed and managed web content for the competition.

ADDITIONAL EXPERIENCE

Tufts University Department of Urban and Environmental Policy and Planning, Medford, MA. *Web Manager*, 2008 – 2010.

Save the Harbor / Save the Bay, Boston, MA. *Senior Marine Educator*, 2008.

Boston College Geology and Geophysics Department, Chestnut Hill, MA. *Research Assistant*, Fall 2007 – Spring 2008.

Boston College, Chestnut Hill, MA. *Student Tutor*, Spring 2007 – Spring 2008.

EDUCATION

Tufts University, Medford, MA

Master of Arts in Urban and Environmental Planning and Policy, 2010.

Boston College, Chestnut Hill, MA

Bachelor of Science in Geophysics, 2008. Minors in mathematics and philosophy. Dean's List all semesters. Best Undergraduate Presentation; BC Geology and Geophysics Dept. Student Colloquium 2006. Member of Golden Key International Honor Society, Slavic Honor Society.

PUBLICATIONS

Knight, P., J. Frost, T. Fitch, E. Sinclair, J. Tabernero, O. Griot, B. Havumaki, J. Smith, L. Metz, S. Chavin. 2023. *TVA's Clean Energy Future: Charting a course to decarbonization in the Tennessee Valley*. Synapse Energy Economics for GridLab and Center for Biological Diversity.

Litynski, J., E. Carlson, P. Knight, J. Tabernero. 2023. *Gibbstown LNG Export Terminal: Lifecycle GHG Emissions Analysis*. Synapse Energy Economics for Delaware Riverkeeper Network.

Goldberg, D., S. Chavin, J. Tabernero, P. Knight. 2023. *Green Dash Northeast: state-level data on emissions and energy in the Northeast*. Synapse Energy Economics for Barr Foundation.

Knight, P., O. Griot, J. Litynski, E. Carlson, J. Smith, E. Sinclair, S. Kwok) and Climable.org (Stevenson-Zepeda, J., S. Kelly). 2022. *Technical Potential of Solar in Massachusetts Study*. Synapse Energy Economics and Climable.org for Massachusetts Department of Energy Resources.

Knight, P., J. Smith. 2022. *Clearing the Air on Coal CCS*. Synapse Energy Economics for Sierra Club.

Frost, J., P. Knight, J. Litynski, O. Griot, J. Smith. 2022. *Transforming Transportation in North Carolina*. Synapse Energy Economics for Sierra Club.

Frost, J., A. Takasugi, B. Havumaki, P. Knight. 2022. *Transforming Transportation in Michigan: A Roadmap to the State's 2050 Climate Target*. Synapse Energy Economics for Sierra Club.

Camp, E., A. Takasugi, P. Knight. 2021. *Analysis of Wind Curtailment in Southern Power Pool, 2018-2019*. Synapse Energy Economics for Union of Concerned Scientists.

Synapse Energy Economics, Resource Insight, Les Deman Consulting, Northside Energy, Sustainable Energy Advantage. 2021. *Avoided Energy Supply Components in New England: 2021 Report*. Synapse Energy Economics for AESC 2021 Study Group.

Hopkins, A.S., P. Knight, J. Frost. 2021. *Rhode Island Carbon Pricing Study*. Synapse Energy Economics and the Cadmus Group for the Rhode Island Office of Energy Resources.

Knight, P., S. Letendre, E. Camp. 2020. *Solar Savings in New England*. Synapse Energy Economics for Renewable Energy Vermont.

Knight, P., C. Odom, E. Camp, D. Bhandari, J. Frost. 2020. *Solar Siting Opportunities for Rhode Island: An analysis of potentials and costs of rooftop, landfill, gravel pit, brownfield, commercial and industrial ground-mounted and carport solar*. Synapse Energy Economics for Rhode Island Office of Energy Resources.

Camp, E., J. Hall, P. Knight, C. Odom. 2020. *Investing in Public Infrastructure in Massachusetts: Impacts of Investment in Clean Energy, Water, and Transportation*. Synapse Energy Economics for Labor Network for Sustainability.

Knight, P. J. Frost, J. Kallay. S. Letendre. J. Hall. 2020. *Assessing the Impacts Climate Change May Have on Maine's Economy, Revenues, and Investment Decisions*. Synapse Energy Economics and Eastern

Research Group for the State of Maine's Department of the Governor's Office of Policy Innovation and the Future.

Knight, P., E. Camp, D. Bhandari, J. Hall, M. Whited, B. Havumaki, A. Allison, N. Peluso, T. Woolf. 2019. *Making Electric Vehicles Work for Utility Customers: A Policy Handbook for Consumer Advocates*. Synapse Energy Economics for the Energy Foundation.

Knight, P., J. Frost. 2019. *Transforming Transportation in New York: Roadmaps to a Transportation Climate Target for 2035*. Synapse Energy Economics for Sierra Club.

Knight, P., E. Camp, C. Odom, E. Malone, M. Whited, J. Hall. 2019. *Exploring Equity in Residential Solar: A preliminary examination of who is installing solar in the Commonwealth of Massachusetts*. Synapse Energy Economics.

Knight, P., N. Peluso, C. Camp, P. Yuen, J. Gifford. 2019. *Expanding Maine's Renewable Portfolio Standard: Creating Economic and Environmental Benefits for Maine*. Synapse Energy Economics and Sustainable Energy Advantage for Maine Renewable Energy Association.

Suphachalasai, S., M. Touati, F. Ackerman, P. Knight, D. Glick, A. Horowitz, J.A. Rogers, T. Amegroud. 2018. *Morocco – Energy Policy MRV: Emission Reductions from Energy Subsidies Reform and Renewable Energy Policy*. Prepared for the World Bank Group.

Hopkins, A. S., P. Knight, N. Peluso. 2018. *Massachusetts Comprehensive Energy Plan: Commonwealth and Regional Demand Analysis*. Synapse Energy Economics, Sustainable Energy Advantage, and MA DOER for the Massachusetts Department of Energy Resources.

Knight, P., D. Goldberg, E. Malone, A. S. Hopkins, D. Hurley. 2018. *Getting SMART: Making sense of the Solar Massachusetts Renewable Target (SMART) program*. Prepared for Cape Light Compact.

Knight, P., E. Camp, D. Glick, M. Chang. 2018. *Analysis of the Avoided Costs of Compliance of the Massachusetts Global Warming Solutions Act*. Supplement to 2018 AESC Study. Synapse Energy Economics for Massachusetts Department of Energy Resources and Massachusetts Department of Environmental Protection.

Knight, P., A. Horowitz, S. Fields, N. Peluso. 2018. *Clean Energy for Los Angeles: An analysis of a pathway for 100 percent renewable energy in Los Angeles by 2030*. Synapse Energy Economics for Food & Water Watch.

Synapse Energy Economics (Knight P., M. Chang, D. White, N. Peluso, F. Ackerman, J. Hall), Resource Insight, etc. 2018. *Avoided Energy Supply Components in New England: 2018*. Synapse Energy Economics and others for Avoided-Energy-Supply-Component (AESC) Study Group.

Peterson, P., D. Hurley, P. Knight. 2018. *Understanding ISO New England's Operational Fuel Security Analysis*. Prepared for Conservation Law Foundation, Acadia Center, New Hampshire Office of the Consumer Advocate, PowerOptions, RENEW Northeast, Vermont Energy Investment Corporation.

Hopkins, A. S., A. Horowitz, P. Knight, K. Takahashi, T. Comings, P. Kreycik, N. Veilleux, J. Koo. 2017. *Northeast Regional Assessment of Strategic Electrification*. Synapse Energy Economics and Meister Consulting Group for the Northeast Energy Efficiency Partnerships.

Knight, P., S. Fields, F. Ackerman, T. Comings, A. Allison. 2017. *Empowering Kentucky: A no-regrets plan to create jobs, improve health, lower bills, and invest in a just transition while cutting harmful emission*. Synapse Energy Economics for Kentuckians for the Commonwealth.

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.

Ackerman, F., P. Knight, B. Biewald. 2016. "Estimating the Cost of Saved Energy: The EIA 861 Database." Synapse Energy Economics.

Woolf, T., M. Whited, P. Knight, T. Vitolo, K. Takahashi. 2016. *Show Me the Numbers: A Framework for Balanced Distributed Solar Policies*. Synapse Energy Economics for Consumers Union.

Stanton, E. A., P. Knight, P. Luckow, A. Allison, T. Vitolo. 2016. *Envisioning Pennsylvania's Energy Future: Powering the Commonwealth's Energy Needs with 100 Percent Renewables by 2050*. Synapse Energy Economics for Delaware Riverkeeper Network.

Wilson, R., S. Fields, P. Knight, E. McGee, W. Ong, N. Santen, T. Vitolo, E. A. Stanton. 2016. *Are the Atlantic Coast Pipeline and the Mountain Valley Pipeline Necessary? An examination of the need for additional pipeline capacity in Virginia and Carolinas*. Synapse Energy Economics for Southern Environmental Law Center and Appalachian Mountain Advocates.

Stanton, E. A., P. Knight, A. Allison, T. Comings, A. Horowitz, W. Ong, N. R. Santen, K. Takahashi. 2016. *The RGGI Opportunity 2.0: RGGI as the Electric Sector Compliance Tool to Achieve 2030 State Climate Targets*. Synapse Energy Economics for Sierra Club, Pace Energy and Climate Center, and Chesapeake Climate Action Network.

Stanton, E. A., P. Knight, A. Allison, T. Comings, A. Horowitz, W. Ong, N. R. Santen, K. Takahashi. 2016. *The RGGI Opportunity: RGGI as the Electric Sector Compliance Tool to Achieve 2030 State Climate Targets*. Synapse Energy Economics for Sierra Club, Pace Energy and Climate Center, and Chesapeake Climate Action Network.

Knight, P., E.A. Stanton. 2016. *Sorting Out New England's Pipeline Needs: A Round Up of Recent Studies and What They Mean*. Synapse Energy Economics.

Knight, P., A. Allison, W. Ong, N. R. Santen, E. A. Stanton. 2015. *Cutting Electric Bills with the Clean Power Plan*. Synapse Energy Economics.

Jackson, S., N. R. Santen, P. Knight, S. Fields, B. Biewald, E. A. Stanton. 2015. *Clean Power Plan Handbook: A Guide to the Final Rule for Consumer Advocates*. Synapse Energy Economics for National Association of State Utility Consumer Advocates.

Knight, P., S. Fields, S. Jackson, W. Ong, N. R. Santen, B. Biewald, E. A. Stanton. 2015. *Multi-State Compliance with the Clean Power Plan in CP3T*. Synapse Energy Economics for the National Association of State Utility Consumer Advocates.

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.

Knight, P., J. Daniel 2015. *Forecasting Coal Unit Competitiveness: Coal Retirement Assessment Using Synapse's Coal Asset Valuation Tool (CAVT) - 2015 Update*. Synapse Energy Economics.

Knight, P., A. Allison, E.A. Stanton. 2015. Preliminary Clean Power Plan Analysis for Kentucky. Synapse Energy Economics for Kentuckians for the Commonwealth.

Stanton, E. A., P. Knight, J. Daniel, B. Fagan, D. Hurley, J. Kallay, E. Karaca, G. Keith, E. Malone, W. Ong, P. Peterson, L. Silvestrini, K. Takahashi, R. Wilson. 2015. *Massachusetts Low Gas Demand Analysis: Final Report*. Synapse Energy Economics for the Massachusetts Department of Energy Resources.

Fields, S., E. A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, K. Takahashi. 2014. *Calculating Alabama's 111(d) Target*. Synapse Energy Economics for the Southern Environmental Law Center.

Fields, S., E. A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, K. Takahashi. 2014. *Calculating Georgia's 111(d) Target*. Synapse Energy Economics for the Southern Environmental Law Center.

Fields, S., E. A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, K. Takahashi. 2014. *Alternate Scenarios for 111(d) Implementation in North Carolina*. Synapse Energy Economics for the Southern Environmental Law Center.

Stanton, E. A., J. Daniel, T. Vitolo, P. Knight, D. White, G. Keith. 2014. *Net Metering in Mississippi: Costs, Benefits, and Policy Considerations*. Synapse Energy Economics for the Public Service Commission of Mississippi.

Knight, P. 2014. "AVERT and 111(d)." Presentation at the EPA Carbon Standards Technical Meeting for Midwest Advocates, July 24, 2014.

Knight, P., D. Hurley, S. Fields. 2014. *Energy Efficiency in U.S. Capacity Markets*. Synapse Energy Economics.

Comings, T., J. Daniel, P. Knight, T. Vitolo. 2014. *Air Emission and Economic Impacts of Retiring the Shawnee Fossil Plant*. Synapse Energy Economics for the Kentucky Environmental Foundation.

Hurley, D., P. Knight, J. Daniel, S. Fields. 2014. *Brayton Point Capacity Payment Requirement Analysis*. Synapse Energy Economics for Consumer Advocates of New England.

Fisher, J., P. Knight, E. A. Stanton, and B. Biewald. 2014. *Avoided Emissions and Generation Tool (AVERT): User Manual*. Version 1.0. Synapse Energy Economics for the U.S. Environmental Protection Agency.

Ackerman, F., M. Whited, P. Knight. 2014. "Would banning atrazine benefit farmers?" *International Journal of Occupational and Environmental Health* 20(1): 61–70.

Knight, P., E. A. Stanton, J. Fisher, B. Biewald. 2013. *Forecasting Coal Unit Competitiveness: Coal Retirement Assessment Using Synapse's Coal Asset Valuation Tool (CAVT)*. Synapse Energy Economics for Energy Foundation.

Ackerman, F., M. Whited, P. Knight. 2013. *Atrazine: Considering the Alternatives*. Synapse Energy Economics for Natural Resources Defense Council (NRDC).

Takahashi, K. et al. 2013. *Economic and Environmental Analysis of Residential Heating and Cooling Systems: A Study of Heat Pump Performance in U.S. Cities*. Proceeding of the 7th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'13), September 12, 2013.

Knight, P., B. Biewald, J. Daniel. 2013. *Displacing Coal: An Analysis of Natural Gas Potential in the 2012 Electric System Dispatch*. Synapse Energy Economics for Energy Foundation.

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.

Nogee, A., M. Chang, P. Knight, E.A. Stanton. 2013. *Electricity Market Restructuring and the Nuclear Industry*. Synapse Energy Economics for Whitt Law.

Stanton, E. A., P. Knight, F. Ackerman. 2013. *LaSalle Fleet Benefits Rebuttal*. Synapse Energy Economics for Whitt Law.

Stanton, E. A., T. Comings, K. Takahashi, P. Knight, T. Vitolo, E. Hausman. 2013. *Economic Impacts of the NRDC Carbon Standard*. Synapse Energy Economics for Natural Resources Defense Council (NRDC).

Whited, M., D. White, S. Jackson, P. Knight, E.A. Stanton. 2013. *Declining Markets for Montana Coal*. Synapse Energy Economics for Northern Plains Resource Council.

Comings, T., P. Knight, E. Hausman. 2013. *Midwest Generation's Illinois Coal Plants: Too Expensive to Compete? (Report Update)*. Synapse Energy Economics for Sierra Club.

Stanton, E. A., F. Ackerman, T. Comings, P. Knight, T. Vitolo, E. Hausman. 2013. *Will LNG Exports Benefit the United States Economy?* Synapse Energy Economics for Sierra Club.

Vitolo, T., G. Keith, B. Biewald, T. Comings, E. Hausman, P. Knight. 2013. *Meeting Load with a Resource Mix Beyond Business as Usual: A regional examination of the hourly system operations and reliability implications for the United States electric power system with coal phased out and high penetrations of efficiency and renewable generating resources*. Synapse Energy Economics for Civil Society Institute.

Hornby, R., R. Fagan, D. White, J. Rosenkranz, P. Knight, R. Wilson. 2012. *Potential Impact of Replacing Retiring Coal Capacity in the Midwest Independent System Operator (MISO) Region with Natural Gas or Wind Capacity*. Synapse Energy Economics for Iowa Utilities Board.

Fagan, R., M. Chang, P. Knight, M. Schultz, T. Comings, E. Hausman, R. Wilson. 2012. *The Potential Rate Effects of Wind Energy and Transmission in the Midwest ISO Region*. Synapse Energy Economics for Energy Future Coalition.

Chang, M., D. White, P. Knight, B. Biewald. 2012. *Energy Benefits Resulting from the Investment of 2010 RGGI Auction Revenues in Energy Efficiency*. Synapse Energy Economics for Regulatory Assistance Project.

Steinhurst, W., P. Knight, M. Schultz. 2012. *Hydropower Greenhouse Gas Emissions: State of the Research*. Synapse Energy Economics for Conservation Law Foundation and Pew Research Center.

Keith, G., B. Biewald, E. Hausman, K. Takahashi, T. Vitolo, T. Comings, P. Knight. 2011. *Toward a Sustainable Future for the US Power Sector: Beyond Business as Usual 2011*. Synapse Energy Economics for Civil Society Institute.

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