Jeremiah Johnson, Ph.D.

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RESEARCH INTERESTS

Energy systems analysis, environmental impacts of renewable energy integration and energy storage, industrial ecology, life cycle assessment, anthropogenic material flows

ACADEMIC POSITIONS

2017-	Associate Professor, Department of Civil, Construction & Environmental Engineering, North Carolina State University
2017-	Adjunct Professor, School for Environment & Sustainability, University of Michigan
2014-2017	Assistant Professor, School of Natural Resources & Environment, University of Michigan Core Faculty: Center for Sustainable Systems
2012-2014	Assistant Research Scientist, School of Natural Resources & Environment, University of Michigan

EDUCATION

2007	**Ph.D.,** Yale University, Chemical and Environmental Engineering Dissertation: "Material flows and energy use in anthropogenic metal cycles," *distinguished rating* Chair: Thomas Graedel Outstanding Doctoral Dissertation Award from the Association of Environmental Engineering and Science Professors (AEESP) & CH2MHill
2004	**M.S.**, Yale University, Chemical and Environmental Engineering
2001	**B.S.**, Clarkson University, Department of Chemical Engineering, Environmental Engineering Concentration; *Highest University Honors*

OTHER PROFESSIONAL EXPERIENCE

2007-2012	Principal Consultant, PA Consulting Group, Global Energy Practice, Cambridge, MA
2006-2007	Project Manager, Hawaii Island Sustainable Energy Initiative, The Kohala Center, Kamuela, HI
2002	Environmental Health & Safety Co-op, Cargill Corn Milling Operations, Cedar Rapids, IA

PROFESSIONAL AFFILIATIONS

- International Society for Industrial Ecology (ISIE)
- Association of Environmental Engineering and Science Professors (AEESP)
- Institute for Operations Research and the Management Sciences (INFORMS)

ARTICLES IN PREPARATION

- Arbabzadeh, M., Sioshansi, R., Keoleian, G., **Johnson, J.X.**, *Bulk Energy Storage for Time-Shifting and Greenhouse Gas Reductions Under Varying Renewable Energy Penetrations*
- Mitchell-Ward, N., **Johnson, J.X.**, *Improving Land Use Efficiency for Fixed-Tilt Utility-Scale Solar*
- Kern, A., Mégel, O., Johnson, J.X., Mathieu, J., *Stochastic Dual Dynamic Programming using Lagrange Relaxation to Approximate the Non-Convex Storage Complementary Constraint*

- Neema, B., **Johnson, J.X.**, *Carbon Mitigation Potential of Grid Scale Battery Energy Storage for Peak Load Shaving Application*
- Afshari, S., Wolfe, J., Nazir, M. Hiskens, I.A., **Johnson, J.X.**, Mathieu, J.L., Lin, Y., Barnes, A.K., Geller, D.A., Backhaus, S.N., *An Experimental Study of Energy Consumption in Buildings Providing Ancillary Services*
- Mueller, K., **Johnson, J.X.**, DeCarolis, J., *Life Cycle Assessment of Reverse Electrodialysis*
- Hollingsworth, J., **Johnson, J.X.**, DeCarolis, J., *Environmental and Economic Impacts of Greenhouse-Integrated Solar Photovoltaics*
- Alfaro, J., Miller, S., **Johnson, J.X.**, *Understanding the Decision between Centralized and Decentralized Generation with Renewable Energy for Rural Electrification Using Agent-Based Model*

REFEREED PUBLICATIONS

Google Scholar: Total citations – 690; h-index – 12

30. Ryan, N.A., Lin, Y., Mitchell-Ward, N., Mathieu, J., Johnson, J.X., *Life Cycle Environmental Impacts of using Li-Ion Batteries for Power System Reserves*, in review, 2017.
29. Ryan, D., **Johnson, J.X.**, *Determining Power System Capacity Value of Steam-Constrained Cogeneration*, in review, 2017.
28. Lin, Y., Mathieu, J., **Johnson, J.X.,** Hiskens, I.A., Backhaus, S., *Explaining Inefficiencies in Commercial Buildings Providing Power System Ancillary Services*, Energy and Buildings, 152: 216-226, 2017.
27. **Johnson, J.X.**, *Location or Insolation: the Importance of Siting in Emissions Mitigation from Solar Photovoltaics*, WIREs Energy and Environment, 6: 1-11, 2017.
26. Forrester, S., Zaman, A. Mathieu, J., **Johnson, J.X.**, *Policy Barriers for Multiple Services from Energy Storage*, Electricity Journal, in press, 2017. [Editorial review]
25. Ryan, N.A., **Johnson, J.X.**, Keoleian, G.A., Lewis, G., *Decision Support Algorithm to Guide Method Selection for Quantifying Emissions from Electricity Consumption*, Journal of Industrial Ecology, in press, 2017.
24. Arbabzadeh, M., Keoleian, G.A., **Johnson, J.X.**, *Parameters Driving Environmental Performance of Energy Storage Systems Across Grid Applications*, Journal of Energy Storage, 12: 11-28, 2017.
23. Novacheck, J., **Johnson, J.X.**, *Diversifying Wind in Real Power Systems*, Renewable Energy, 106: 177-185, 2017.
22. Alfaro, J.F., Miller, S.A., **Johnson, J.X.**, Riolo, R.R., *Agent Based Modeling for Stakeholder Engagement and Decision Making in Electricity System Planning*, Energy Policy, 101: 317–331, 2017.
21. Ryan, N., Keoleian, G.A., **Johnson, J.X.**, *Comparative Assessment of Models and Methods to Calculate Grid Electricity Emissions*, Environmental Science & Technology, 50(17): 8937–8953, 2016.
20. Chiang, A., Keoliean, G., Moore, M.R., **Johnson, J.X.,** *Emission Abatement Costs and Benefits of Siting an Offshore Wind Farm: A Spatial Analysis of Lake Michigan*, Ecological Economics, 130: 263-276, 2016.
19. Good, J., **Johnson, J.X.,** *Impact of Inverter Loading Ratio on Solar Photovoltaic System Performance*, Applied Energy, 177: 475–486, 2016.
18. Lin, Y., **Johnson, J.X.,** Mathieu, J., *Emissions Impacts of Using Distributed Energy Storage for Power System Reserves*, Applied Energy, 168: 444-456, 2016.
17. Arbabzadeh, M., **Johnson, J.X.**, Keoleian, G.A., Rasmussen, P., Thompson, L., *Twelve Principles for Green Energy Storage in Grid Applications*, Environmental Science & Technology, 50(2): 1046-1055, 2016.

16. **Johnson, J.X.**, Novacheck, J., *The Impact of Coal Plant Retirements on Emissions Mitigation from Renewable Portfolio Standards,* The Electricity Journal, 28 (8): 59–68, 2015. [Editorial review]
15. Novacheck, J., **Johnson, J.X**., *The Environmental and Cost Implications of Solar Energy Preferences in Renewable Portfolio Standards*, Energy Policy, 86: 250-261, 2015.
14. **Johnson, J.X.**, Novacheck, J., *Emissions Reductions from Expanding State-Level Renewable Portfolio Standards,* Environmental Science & Technology, 49(9): 5318-5325, 2015.
13. Arbabzadeh, M., **Johnson, J.X.**, De Kleine R., Keoleian, G.A., *Vanadium redox flow batteries to reach greenhouse gas emissions targets in an off-grid configuration,* Applied Energy, 146: 397-408, 2015.
12. **Johnson, J.X.**, De Kleine R., Keoleian, G.A., *Assessment of Energy Storage for Transmission-Constrained Wind,* Applied Energy, 124: 377–388, 2014.
11. **Johnson, J.X.**, McMillan, C.A., Keoleian, G.A., *Evaluation of Life Cycle Assessment Recycling Allocation Methods: The Case Study of Aluminum*, Journal of Industrial Ecology, 17 (5): 700–711, 2013.
10. **Johnson, J.**, Chertow, M., *Climate Stabilization Wedges in Action: A Systems Approach to Energy Sustainability for Hawaii Island,* Environmental Science & Technology, 43(7): 2234-2240, 2009.
9. **Johnson, J.**, Reck, B., Wang, T., Graedel, T.E., *The Energy Benefit of Stainless Steel Recycling,* Energy Policy, 36 (1): 181-192, 2008.
8. **Johnson, J.**, Graedel, T.E., *The "Hidden" Trade of Metals in the United States*, Journal of Industrial Ecology, 12 (5/6): 739-751, 2008.
7. Wang, T., Mao, J., **Johnson, J.**, Reck, B., Graedel, T.E., *Anthropogenic Metal Cycles in China*, Journal of Material Cycles and Waste Management, 10 (2): 188-197, 2008.
6. **Johnson, J.**, Harper, E.M., Lifset, R., Graedel, T.E., *Dining at the Periodic Table: Metals Concentrations as They Relate to Recycling,* Environmental Science & Technology, 41(5): 1759-1765, 2007.
5. **Johnson, J.**, Schewel, L., Graedel, T.E., *The Contemporary Anthropogenic Chromium Cycle*, Environmental Science & Technology, 40 (22): 7060-7069, 2006.
4. Harper, E.M., **Johnson, J.**, Graedel, T.E., *Making Metals Count: Applications for Material Flow Analysis*, Environmental Engineering Science, 23 (3): 493-506, 2006.
3. **Johnson, J.**, Gordon, R.B., Graedel, T.E., *Silver Cycles: The Stocks and Flows Project, Part 3*, JOM: Journal of the Minerals, Metals, and Materials Society, 58 (2): 34-38, 2006.
2. **Johnson, J.**, Jirikowic, J., Bertram, M., van Beers, D., Gordon, R.B., Henderson, K., Klee, R.J, Lanzano, T., Oetjen, L., Graedel, T.E., *Contemporary Anthropogenic Silver Cycle: A Multilevel Analysis*, Environmental Science & Technology, 39 (12): 4655-4665, 2005. [Featured on cover]
1. **Johnson, J.**, Bertram, M., Henderson, K., Jirikowic, J., Graedel, T.E., *The Contemporary Asian Silver Cycle: One-Year Stocks and Flows*, Journal of Material Cycles and Waste Management, 7 (2): 93-103, 2005.

CONFERENCE PROCEEDINGS

4. Afshari, S., Wolfe, J., Nazir, M. Hiskens, I.A., **Johnson, J.X.**, Mathieu, J.L.,Lin, Y., Barnes, A.K., Geller, D.A., Backhaus, S.N., *An Experimental Study of Energy Consumption in Buildings Providing Ancillary Services*, IEEE Integrated Smart Grid Technologies Conference (IGST), 2017.
3. Lin, Y., Mathieu, J., **Johnson, J.X.,** *Stochastic optimal power flow formulation for environmental dispatch strategy with energy storage*, IEEE 19th Power Systems Computation Conference (PSCC), 2016.
2. Lin, Y., Hiskens, I., Backhaus, S., **Johnson, J.X.,** Mathieu, J. *Explaining inefficiencies in buildings providing ancillary services*, 2016 ACEEE Summer Study on Energy Efficiency in Buildings, August 2016.

1. **Johnson, J.**, Chertow, M., *A Systems Approach to Energy Sustainability in Hawai'i County*, IEEE Proceedings of the 42nd Hawaii International Conference on System Sciences, Waikoloa, Hawaii, 2009.

NON-REFEREED PUBLICATIONS

- **Johnson, J.**, Novacheck, J., Barteau, M., Lyon, T., Expanding the Renewable Portfolio Standard for Michigan: A Study, University of Michigan Energy Institute, January 2015.
- **Johnson, J.**, Chertow, M., Davies, M., Gagne, C., Hausfather, Z., Lippert, D., Analysis and Recommendations for the Hawaii County Energy Sustainability Plan, The Kohala Center, 2007.
- **Johnson, J.**, book review for "Transforming Sustainability Strategy into Action: The Chemical Industry", Ecological Economics, 61: 194-195, 2007.
- **Johnson, J.**, Leistra, D., Opton-Himmel, J., Smith, M., Baseline Energy Analysis for Hawaii Island, sponsored and distributed by the Kohala Center, Kamuela, Hawaii, 2006.

FUNDING AND AWARDS

- North Carolina Policy Collaboratory, Co-PI (PI: J DeCarolis), North Carolina Energy Storage Study, 2017-2018, **$200,000**.
- University of Michigan Office of Research and Rackham Graduate School: Distinguished Faculty & Grad Student Seminars Program, Co-PI (PI: J. Mathieu), Emerging Topics in Sustainable Electric Power Systems, 2016-2017, **$15,000**.
- National Science Foundation: Environmental Sustainability, Co-PI (PI: M. Xu), UNS: U.S.-China: Integrated Systems Modeling of Food-Energy-Water (FEW) Nexus for Urban Sustainability, 2016-2020, **$499,990**.
- National Science Foundation: Environmental Sustainability, PI (Co-PI: J. Mathieu), Environmental Impacts of Using Distributed Energy Storage for Power System Reserves, 2015-2018, **$310,000**.
- University of Michigan, Transforming Learning for a Third Century Program, Co-PI (with 18 others), Transforming Sustainability Education and Case-Based Teaching, 2015-2018, **$1,595,749**.
- University of Michigan Energy Institute, with J. Mathieu, Assessing the Environmental Impacts of Providing Power System Reserves with Demand Response and Distributed Energy Storage – Grant Renewal, 2015, **$40,000**.
- University of Michigan, M-Cubed, Co-PI (with J. Mathieu, I. Hiskens), Improving the Energy Efficiency of Buildings Participating in Power System Ancillary Services, 2015-2016, **$60,000**.
- U.S.-China Clean Energy Research Center, Co-PI (with G. Keoleian), Electricity and Material Sourcing Scenario Analysis to Guide Vehicle Technology Strategies Implementation Proposal, 2015, **$68,000**.
- 5 Lakes Energy, PI, A Dynamic Tool for Evaluating Carbon Mitigation Options from Existing Power Plants in Michigan, Phase II, 2015, **$54,251**.
- University of Michigan Energy Institute, with J. Mathieu, Assessing the Environmental Impacts of Providing Power System Reserves with Demand Response and Distributed Energy Storage, 2014, **$40,000**.
- The Energy Foundation and 5 Lakes Energy, PI, A Dynamic Tool for Evaluating Carbon Mitigation Options from Existing Power Plants in Michigan, 2014, **$45,622**.
- University of Michigan Energy Institute, PI, Evaluation of Alternative Design Considerations for Renewable Portfolio Standards, 2014, **$45,200**.

- National Science Foundation: Sustainable Energy Pathways Program, Co-PI (by invitation; PI: L. Thompson), Non-Aqueous Redox Flow Battery Chemistries for Sustainable Energy Storage, 2012-2016, **$1,750,000**.
- University of Michigan: Rackham Centennial Fellowship, Student Support – Josh Novacheck, Environmental Impacts of Various Renewable Grid Integration, 2013, **$6,000**.
- Association of Environmental Engineering and Science Professors (AEESP) & CH2MHill Outstanding Doctoral Dissertation Award, 2007, **$1,000**.
- International Precious Metals Institute: Student Award, 2004, **$1,500**.
- Intel Award for Environmental Innovation, 2002.

PRESENTATIONS [* = INVITED; # = KEYNOTE]

- 2017: ASME Power and Energy Conference; University of Michigan Emerging Topics in Sustainable Electric Power Systems Seminar Series; INFORMS; International Society for Industrial Ecology/International Symposium for Sustainable Systems and Technology (x4); Association of Environmental Engineering and Science Professors (x3)
- 2016: INFORMS; ACEEE Summer Study on Energy Efficiency in Buildings; IEEE 19th Power Systems Computation Conference; EPRI ENV-Vision*; International Symposium for Sustainable Systems and Technology (x4)
- 2015: Golisano Institute of Sustainability, Rochester Institute of Technology*; Electrochemical Society (ECS) Meeting; Energy Policy Research Conference; International Society for Industrial Ecology (x3); Association of Environmental Engineering and Science Professors; International Symposium for Sustainable Systems and Technology (x2); Engineering Sustainability
- 2014: IEEE Power & Energy Society General Meeting; EPA Carbon Standards Technical Meeting*; International Symposium for Sustainable Systems and Technology (x2); University of Michigan – SNRE*; University of Michigan – Env Eng*; Purdue University*
- 2013: Yale University*; Midland American Chemical Society Fall Scientific Meeting #
- 2012: University of Michigan – SNRE
- 2009: Columbia University*; Massachusetts Institute of Technology*; University of California Santa Barbara*; Hawaii International Conference on System Sciences
- 2007: National Research Council of the National Academies*
- 2006: Gordon Research Conference on Industrial Ecology; International Stainless Steel Forum; CHROMIUM*
- 2005: International Society for Industrial Ecology; National Science Foundation Conference on Biocomplexity in the Environment
- 2004: Gordon Research Conference on Industrial Ecology
- 2001: International Waste Education and Research Consortium

TEACHING

North Carolina State University

- CE297: Sustainable Infrastructure (Fall 2017)
- CE796: Environmental Life Cycle Assessment (Spring 2018)

University of Michigan

- NRE615: Renewable Electricity & the Grid (Winter 2015, 2016, 2017)
- NRE550/STRAT566: Systems Thinking for Sustainable Development & Enterprise (Winter 2016, 2017)

- Dow Sustainability Academy – Executive Education at Ross School of Business (2017)
- Guest lectures: ESE501 (Fall 2014, Fall 2015, Fall 2016); CEE567 (Winter 2015); ENG100 (Fall 2013); UROP (Summer 2015)

Yale University

- FES500: Greening the Industrial Facility, Teaching Fellow, two semesters
- FES300: Technology and Environment, Teaching Fellow, one semester
- CENG120: Introduction to Environmental Engineering, Teaching Fellow, one semester

PUBLISHED TEACHING CASES

5. Kraus, A., Mashburn, B., **Johnson, J.X.**, *Green Mountain Power & Tesla Powerwall: Innovation within a Conservative Industry*, Michigan Sustainability Case, 2016.
4. Szczepanik, B., Cole, D., Neema, B., Taddei Arriola, P.D., **Johnson, J.X.**, *A Radioactive Decision: Should DTE Energy Build Fermi III?*, Michigan Sustainability Case, 2016.
3. Golrokian, M., Ilayian, R., **Johnson, J.X.**, *Ohio Renewable Energy Portfolio Standard Freeze*, Michigan Sustainability Case, 2016.
2. Miranda-Blackney, T., Cui, Y., Santiago, A., Talbot, J., **Johnson, J.X.**, *Renewable Energy at the National Aquarium*. WDI Publishing, case 1-430-451, 2016.
1. Ryan, D., Bednar, D., Cecco, L., MV Reddy, P., **Johnson, J.X.**, *Evading the Death Spiral: Minnesota's Value of Solar Tariff*. WDI Publishing, case 1-430-450, 2015.

STUDENT ADVISEES

Doctoral students

- (Co-chair) Nicole Ryan, School of Natural Resources & Environment, University of Michigan, September 2016 to present
- (Co-chair) Maryam Arbabzadeh, School of Natural Resources & Environment, University of Michigan, September 2013 to present; recipient of Dow Doctoral Fellowship, Barbour Scholarship (declined), and Rackham Pre-doctoral Fellowship

Doctoral student committees

- Morteza Taiebat, University of Michigan, September 2016 to present
- Vineet Raichur, Design Science Program, University of Michigan, August 2015

Post-doctoral fellows

- Sina Afshari, 2016-2017, currently: Ecosense Lighting
- Yashen Lin, 2014-2016, currently: National Renewable Energy Laboratory

Master's theses

- (Co-Chair) Sydney Forrester, School for Environment and Sustainability, September 2016 to present
- (Chair) Bhuvan Neema, School for Environment and Sustainability, November 2015 to present
- (Committee) Kate Mueller, Civil, Construction, & Environmental Engineering, 2017-present
- (Committee) Joseph Hollingsworth, Civil, Construction, & Environmental Engineering, 2017-present
- (Chair) Xinwei Li, School of Natural Resources & Environment, December 2015-2017, currently: doctoral student at UC Davis
- (Chair) Dan Ryan, School of Natural Resources & Environment and Ross School of Business, January 2015-2017, currently: Associate at EDF Renewable Energy
- (Co-Chair) Nicole Ryan, School of Natural Resources & Environment and Mechanical Engineering, 2015-2016, currently: doctoral student at University of Michigan

- (Chair) Shreyas Vangala, School of Natural Resources & Environment, 2015-2016, currently: Strategy Analyst at New York Power Authority
- (Chair) Joshua Novacheck, Mechanical Engineering and School of Natural Resources & Environment, University of Michigan, January 2013 to December 2014; recipient of the Dow Masters Fellowship; currently: Electricity System Research Engineer at the National Renewable Energy Laboratory

Master's projects

- Southeast Michigan Regional Energy Office, Municipal Street Lighting Consortium: Deshpande, Durand, Liang, Liu, McGinnis, 2015-2016
- SunEdison Solar Strategies: Heidenreich, Serron, Kletter, Underwood, Azgaldov, Dahagama, Wolff, 2014-2015
- Transportation Solutions to Reduce Fossil Fuel Dependence on Hawaii Island: Madrazo, Epstein, McManamon, Medina, Wen, 2013-2014

SELECTED SERVICE

- North Carolina State University Energy Collaborative, Organizing Committee (2017-present)
- International Symposium on Sustainable Systems and Technology (ISSST) Organizing Committee (2017-present), Program Co-Chair (2016-present), and Leadership Committee (2014-present)
- Committee member: President Schlissel's Committee on Greenhouse Gas Reduction, 2014-2017.
- Committee member: UM Central Power Plant Expansion Committee, 2016-2017.
- Judge in Renewable Energy Case Competition, Ross School of Business, University of Michigan, 2012, 2014-2016
- Advisor for University of Michigan Social Venture Fund, 2014-2017.
- Committee member: Scholarship (SNRE, Dow Sustainability Fellows), 2016-present
- Committee member: School for Environment and Sustainability Transition Team - Administrative Structures, 2016-present
- Erb Institute Teaching Case Judge, 2014.
- Dow Sustainability Project Advisor, Value of Solar in Michigan, 2014.
- Reviewer: National Science Foundation, Environmental Science & Technology, Nature Energy, Energy Policy, Journal of Industrial Ecology, Applied Energy, Landscape and Urban Planning, PLOS One

PRESS

- Maloney, P., "First do no harm: Michigan researchers publish storage sustainability guidelines" *Utility Dive*, February 22, 2016.
- Balaskovitz, A., "Michigan researchers issue guidelines for sustainable energy storage" *Midwest Energy News*, February 19, 2016.
- Allington, A., "States wavering on standards for renewable energy" *National Public Radio, Marketplace,* July 24, 2015.
- Balaskovitz, A., "Natural gas or renewables? New model helps states decide" *Midwest Energy News*, March 23, 2015.
- Balaskovitz, A., "Energy policy takes center stage in state Legislature this year" *MiBiz*, March 1, 2015.
- Ignaczak, N., "Can we power the Mitten with energy freedom?" *Concentrate*, February 11, 2015.
- WEMU News, interview on Michigan Renewable Portfolio Standard, January 20, 2015.
- Tsao, S., "Study: Higher Michigan RPS would boost wind, solar," *Argus Media*, January 14, 2015.

- WKAR Public Media, interview on Michigan Renewable Portfolio Standard, *Current State*, January 13, 2015.
- Balaskovitz, A., "Michigan study shows 'modest' costs to expand renewables" *Midwest Energy News*, January 13, 2015.
- Balaskovitz, A., "'A tale of two peninsulas': Can Michigan's grid be unified?" *Midwest Energy News*, November 20, 2014.
- Balaskovitz, A., "Biomass key to Upper Peninsula's future renewable portfolio" *Midwest Energy News*, October 28, 2014.
- WKAR Public Media, interview on Presque Isle Power Plant retirement, *Current State*, October 21, 2014.
- Balaskovitz, A., "Will EPA carbon rules push Michigan harder on clean energy?" *Midwest Energy News*, July 1, 2014.
- Johnson, J., "Greener energy for Michigan: study examines impact, cost of increased RPS targets", University of Michigan, Planet Blue, *The Conversation*, June 20, 2014.
- Reed, E., "Will The EPA Take Your Job?" *Main Street*, June 23, 2014.
- Matheny, K., "New coal rules: Good news on Michigan jobs, or bad news on electricity rates?" *Detroit Free Press*, June 2, 2014.
- Neuhauser, A., "State of the Union Preview: Energy and the Environment - Experts weigh in on what Obama may say on energy and environmental policy" *U.S. News & World Report*, January 28, 2014.