

DIPTI KAMATH

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RESEARCH INTERESTS:

- Life cycle assessment
- Techno-economic analysis
- System dynamics
- Industrial decarbonization
- Low carbon fuels, feedstocks, and energy sources
- Industrial ecology and circularity
- Industrial workforce development

EDUCATION:

Ph.D., Environmental Engineering, with dual major in Environmental Science and Policy

August 2016 – December 2020

Advisor: Dr. Annick Anctil, Michigan State University (East Lansing, MI, USA)

Dissertation: *Prospective Life Cycle Assessment Of Second-life Electric Vehicle Batteries And Uranium Extraction In The US.*

Master of Technology, Environmental Engineering and Management

August 2013 – May 2015

Advisor: Dr. Arvind Nema, Indian Institute of Technology Delhi (New Delhi, India), with internship under Dr. Hans Joachim Linke at Technische Universität Darmstadt (Darmstadt, Germany)

Bachelor of Technology, Civil Engineering

August 2008 – May 2012

Government Engineering College Trichur (University of Calicut) (Kerala, India)

WORK EXPERIENCE:

R&D Associate Staff Member

January 2023 – Present

Manager: Dr. Sachin Nimbalkar, Manufacturing Energy Efficiency Research & Analysis Group, Oak Ridge National Laboratory (Oak Ridge, TN, USA)

- Responsible for research for the U.S. DOE's Industrial Efficiency and Decarbonization Office (IEDO) Strategic Analysis Team with other national laboratories
 - Led the techno-economic and life cycle assessment for the case study on integrated biorefinery technologies in pulp & paper industry, focusing on gasification processes for methanol production
 - Supported analysis for the IEDO additive manufacturing energy and cost tools, and supported updating the existing MS-Excel based tools
 - Supported analysis for industrial decarbonization roadmapping
- Responsible for providing techno-economic and life cycle assessment support to different groups across ORNL
 - Provided techno-economic and life cycle assessment support to Bioenergy Technology Office Program Manager at ORNL
 - Conducted a detailed literature review on the techno-economic and life cycle assessment of the various biofuel production processes

- Harmonized the different studies and finalized the input data for different scenarios to be run for optimizing the biomass allocation in the Biofuel Infrastructure, Logistics, and Transportation Model built at ORNL
- Provided techno-economic and life cycle assessment support for the project: Innovative High-Feed Rate Additive Manufacturing Using Sustainable Nano- Micro-Cellulose-Reinforced Thermoplastic Composites (collaboration with University of Maine)
- Assisted in writing research proposals
- Provided Technical Account Manager support to the Better Plants and Better Climate Challenge Programs through activities including, but not restricted to, establishing corporate energy baseline for industrial partners, roadmaps of technical assistance, identifying IEDO resources, developing energy action plans, providing guidance on technical issues, generating reporting materials and records, and participating in trainings.
- Provided analysis support to Better Plants Energy Intensive Industries and contributed to website design and implementation for the pilot program

Postdoctoral Research Associate

May 2021 – December 2022

Manager: Dr. Sachin Nimbalkar, Manufacturing Energy Efficiency Research & Analysis Group, Oak Ridge National Laboratory (Oak Ridge, TN, USA)

- Responsible for research for the U.S. DOE's Industrial Efficiency and Decarbonization Office Strategic Analysis Team with other national laboratories
- Responsible for providing techno-economic and life cycle assessment support to different groups across ORNL
- Assisted in writing research proposals

Graduate Research Assistant

August 2016 – December 2020

Advisor: Dr. Annick Anctil, Michigan State University (East Lansing, MI, USA)

- Responsible for research on Second Life Potential and Environmental Benefit of Electric Vehicle Batteries in Photovoltaic and Grid Applications.
 - Identified potential applications for end-of-life electric vehicle batteries for second life.
 - Determined the economic (annualized cost) and environmental impacts (global warming potential, cumulative demand) of second-life batteries in residential, commercial, and utility-scale applications.
 - Conducted accelerated degradation tests on end-of-life electric vehicles to mimic potential second-life applications.
 - Developed a system dynamics model for assessing the availability of end-of-life batteries and how the demand-supply dynamics affect the costs and environmental impacts associated with the remanufacturing processes.
 - Assisted in the development of decision making web tool for second-life battery applications based on locational differences like electricity pricing and solar radiation.
- Responsible for research on nuclear energy generation and fuel demand over time.
 - Worked on determining the historical nuclear generation capacity, and natural uranium demand and production.
 - Conducted a life cycle inventory of uranium extraction process in the US.

- Responsible for conducting training sessions on life cycle assessment for Hemlock Semiconductor Corporation, MI.
 - Trained two employees at Hemlock Semiconductor Corporation to conduct life cycle assessment, with both theoretical background as well as SimaPro software tutorials.
 - Aided the employees to use the software for conducting the life cycle assessment of their manufacturing processes.
- Led community outreach events such as Introduce a Girl to Engineering camp and 4-H Renewable Energy camp at MSU for middle and high school students.
- Mentored five undergraduate and two high school students to help them gain hands-on experience in research and science communication.
 - Aided in presenting their research through paper and poster presentations at conferences and symposiums.
 - Mentored one of the undergraduate students on writing a manuscript for a peer-reviewed journal, which is currently under progress.
- Assisted in writing research grant applications.

Lecturer

January 2016 – May 2016

National Institute of Technology Calicut (Kozhikode, Kerala, India)

- Undertook teaching and mentoring responsibilities at various levels.
 - Responsible for two courses: AR 1003 Building Materials and AR 3010 Energy Sustainability and Site Planning.
 - Assisted in two courses: AR 1007 Introduction to Architectural Design and AR 1006 Theory of Structures.
 - Mentored two undergraduate students to gain hands-on experience in research for the course AR 4009 Seminar.

Project Assistant

August 2015 – October 2015

Advisor: Dr. Arvind Nema, Indian Institute of Technology Delhi (New Delhi, India)

- Assisted in environmental sustainability analysis of traditional dyeing industry in India.
 - Conducted literature review and data collection for life cycle inventory of the dyeing industry.

Tutor

June 2012 – July 2013

Trace Engineering Solutions (Thrissur, Kerala, India)

- Tutored civil engineering students in multiple subjects, including but not limited to structural design, environmental engineering, and building materials.

HONORS AND AWARDS

- Finalist in ORNL's Your Science In A Nutshell lightning talk competition 2022, Oak Ridge, Tennessee, USA, 2022.
- Outstanding Graduate Student Award 2020-21, Environmental Engineering, Michigan State University, East Lansing, Michigan, USA, 2021.
- 2nd place for oral presentation in Environmental Science and Policy (ESPP) Research Symposium 2019, East Lansing, Michigan, USA, 2019.

- ESPP Network Fellowship, to serve on the organizing committee of the annual interdisciplinary ESPP research symposium, East Lansing, Michigan, USA, 2018.
- MSU ESPP Summer Research Fellowship 2018 on the theme Climate-Food-Energy-Water nexus, East Lansing, Michigan, USA, 2018.
- 5th place in International Society for Industrial Ecology & International Symposium on Sustainable Systems and Technology (ISIE-ISSST) 2017 Conference Poster Competition, Chicago, USA, 2017.
- MSU Environmental Science and Policy Doctoral Recruitment Fellowship, East Lansing, Michigan, USA, 2016-17.
- NBCC Prize of Excellence, Indian Institute of Technology Delhi, India, 2014-15.
- Best Student Award, Government Engineering College Trichur, Kerala, India, 2011-12.

SOFTWARE PROGRAMS

- SimaPro, Open LCA, Stella Architect, MS Excel, HomerPro, Matlab, OriginLabs

VOLUNTEER ACTIVITIES

- Mentor for graduate students through the Industrial Assessment Center Women for Energy Efficiency network (IAC WE2) program in 2022-24.
- Outreach Chair in the Oak Ridge Postdoctoral Association (ORPA) Executive Board for FY2022 at Oak Ridge National Laboratory.
- Member of the Oak Ridge National Laboratory's Energy Science & Technology Division's Fundraising (ESTD Gives) Committee 2021.
- Reviewer for journals, such as Nature Scientific Data and SAE International Journal of Sustainable Transportation, Energy, Environment, & Policy, 2020-Current; as well as conferences, such as IEEE PVSC.
- Reviewer for the National Science Foundation, 2024.
- Member of the American Council of Life Cycle Assessment (ACLCA), Association of Energy Engineers (AEE) 2022-Present
- Member of the ACLCA Student Committee, 2019 for organizing the ACLCA conference, LCA XIX 2019.

PUBLICATIONS AND PRESENTATIONS

1. Publications

Peer-reviewed Journal Articles

[1] Armstrong, K.O., Kamath, D., Zhao, X., Rencheck, M.L., Tekinalp, H., Korey, M., Hun, D. and Ozcan, S., 2023. "Life cycle cost, energy, and carbon emissions of molds for precast concrete: Exploring the impacts of material choices and additive manufacturing." *Resources, Conservation and Recycling (2023)* DOI: **10.1016/j.resconrec.2023.107117**

[2] Kamath, D., Moore, S., Arsenault, R. and Anctil, A. "A system dynamics model for end-of-life management of electric vehicle batteries in the US: Comparing the cost, carbon, and material requirements

of remanufacturing and recycling.” *Resources, Conservation and Recycling* (2023) DOI **10.1016/j.resconrec.2023.107061**

[3] Sundaramoorthy, S., Kamath, D., Nimbalkar, S., Price, C., Wenning, T. and Cresko, J. “Energy Efficiency as a Foundational Technology Pillar for Industrial Decarbonization.” *Sustainability* (2023) DOI **10.3390/su15129487**

[4] Copenhaver, K., Smith, T., Armstrong, K., Kamath, D., Rencheck, M., Bhagia, S., Korey, M., Lamm, M. and Ozcan, S., 2023. “Recyclability of additively manufactured bio-based composites.” *Composites Part B: Engineering* (2023) DOI **10.1016/j.compositesb.2023.110617**

[5] Challa, R., Kamath, D., and Anctil, A., “Well-to-wheel greenhouse gas emissions of electric versus combustion vehicles from 2018 to 2030 in the US” *Journal of Environmental Management* (2022) DOI **10.1016/j.jenvman.2022.114592**

[6] Kamath, D., Shukla, S., Arsenault, R., Kim, H.C., and Anctil, A., “Evaluating the cost and carbon footprint of second-life electric vehicle batteries in residential and utility-level applications” *Waste Management* (2020) DOI **10.1016/j.wasman.2020.05.034**

[7] Kamath, D., Arsenault, R., Kim, H.C., and Anctil, A., “Economic and environmental feasibility of second-life lithium-ion batteries as fast charging energy storage” *Environmental Science & Technology* (2020). DOI **10.1021/acs.est.9b05883**

Journal Articles Under Progress

[1] Oyedegi, O., Moore, A., Kamath, D., Busch, I., Curran, S., Henriksen, M., Jamieson, M., Fout, T., Webb, E., Langholtz, M., and Theiss, T., “Decarbonizing the U.S. natural gas supply with renewable natural gas produced from biomass gasification: An assessment of economic impacts and emission reduction potentials” **<Submitted>**

[2] Moore, S., Kamath, D., and Anctil, A., “Public opinion and anticipated adoption of second-life, remanufactured battery systems for residential energy storage” **<Submitted>**

[3] Kamath, D. and Nimbalkar, S., “Life cycle assessment of integrated biorefineries for paper and pulp industries” **<To be submitted>**

[4] Kamath, D. and Anctil, A., “Life cycle assessment of in-situ leaching for uranium extraction in the US” **<To be submitted>**

[5] Shukla, S., Kamath, D., Arsenault, R., Kim, H.C., and Anctil, A., “Second life battery storage for microgrid applications” **<To be submitted>**

Conference Publications

[1] Kamath, D., Shukla, S., and Anctil, A., 2019. “An economic and environmental assessment of residential rooftop photovoltaics with second-life batteries in the US” 2019 IEEE 46th Photovoltaic Specialists Conference (PVSC), IEEE, 2019. DOI **10.1109/PVSC40753.2019.8981132**

[2] Kamath, D. and Anctil, A., 2018. “Powering India’s villages sustainably: A case study of Bihar.” Emerging Trends in Engineering, Science and Technology for Society, Energy and Environment: Proceedings of the International Conference in Emerging Trends in Engineering, Science and Technology (ICETEST 2018), January 18-20, 2018, Thrissur, Kerala, India, 2018, 213-2019, CRC Press.

Others

[1] Sundaramoorthy, S., Kamath, D., Nimbalkar, S., Price, C., Wenning, T. and Cresko, J. “Energy Efficiency’s Role in Industrial Decarbonization.” *Amplify* (2023), Vol. 36, Issue 11, Cutter Consortium.

[2] Curran, S., Langholtz, M., Busch, I., Kamath, D., Oyedeji, O., and Theiss, T., “Analyzing the Best Uses of Biomass for Energy-Sector Decarbonization via an Integrated Carbon Management Approach”: ORNL Review, Fall 2022 issue, Research Insights article.

[3] Kamath, D., "Prospective Life Cycle Assessment of Second-Life Electric Vehicle Batteries and Uranium Extraction in the US." Order No. 28262835, Doctoral dissertation, Michigan State University, 2020.

[4] Kamath, D., Kiulia, N, Li, H, Suchyta, M, and Zhang, Y, “Managing California’s Groundwater under SGMA: What can Michigan policymakers learn from California’s experience with groundwater management?” ESPPulse, 2017, 24–35.

2. Presentations

Oral Presentations

* - *Presenter of the paper*

[1] Kamath, D.* “What to expect when choosing low-carbon fuels! Green Hydrogen, Renewable Natural Gas, and Alternative Sources of Heat.,” AEE World 2023 Conference, October 25-27, 2023, Orlando, Florida, USA.

[2] Upasani, S.*, Kamath, D., Nimbalkar, S. and Carpenter, A. “Evaluating supply chain greenhouse gas emissions and energy use impacts of implementing decarbonization strategies for the pulp and paper sector through 2050 using the Materials Flows through Industry (MFI) tool.,” ACLCA 2023 Conference, September 26-28, 2023, Burlington, Vermont, USA.

[3] Zhao, X.*, Kamath, D., Armstrong, K., Bran Anleu, P., Sun, H., Uría-Martínez, R., and Paranthaman, P., “Life Cycle Assessment of Low-Carbon, Low-Energy Concrete Alternatives: A Case Study of Carbonated Cementitious Material–Based Precast Panel,” 30th International Symposium on Sustainable Systems and Technology – ISSST 2023, June 13, 2023, Fort Collins, Colorado, USA.

[4] Kamath, D.*, Oyedeji, O., Busch, I., Langholtz, M., Curran, S., Webb, E., and Theiss, T., 2022. “How best to allocate US biomass resources for least-cost decarbonization,” ASABE Annual International Meeting 2022, July 20, 2022, Houston, Texas, USA.

[5] Kamath, D.* and Anctil, A., 2021. “Evaluating the Cost and Carbon Footprint of Second-Life Electric Vehicle Batteries in Residential and Utility-Level Applications,” 38th International Battery Seminar and Exhibit 2021, March 11, 2021, Virtual.

[6] Kamath, D.* and Anctil, A., 2019. “Willingness to Pay for Remanufactured Products,” ESPP Research Symposium 2019, October 28, 2019, East Lansing, Michigan, USA.

[7] Kamath, D.* and Anctil, A., 2019. “Environmental impacts of in-situ leaching for uranium extraction in the US,” LCA XIX Conference 2019, September 24-26, 2019, Tucson, Arizona, USA.

[8] Kamath, D.* and Anctil, A., 2019. “Consequential life cycle assessment of repurposed electric vehicle batteries using systems dynamics forecasting,” LCA XIX Conference 2019, September 24-26, 2019, Tucson, Arizona, USA.

[9] Kamath, D.* and Anctil, A., 2018. “Photovoltaics for rural electrification: Adding the climate change dimension.” ESPP Research Symposium 2018, November 1, 2018, East Lansing, Michigan, USA.

[10] Lee, J.*, Kamath, D., Shukla, S. and Anctil, A., “Economic and environmental assessment of photovoltaics in low-income households,” Housing Education and Research Association (HERA) Conference, October 7-10, 2018, Savannah, Georgia, USA.

[11] Kamath, D.*, Shukla, S. and Anctil, A., 2018. “Potential benefits of second-life EV batteries in photovoltaic applications,” LCA XVII Conference 2018, September 25-27, 2018, Fort Collins, Colorado, USA.

[12] Sun, M.*, Kamath, D. and Anctil, A., 2017. “Assessing Michigan’s potential for a more sustainable energy mix,” ESPP Research Symposium 2017, October 27, 2017, East Lansing, Michigan, USA.

Panels

[1] Cresko, J., Carpenter, A., Supekar, S., Uekert, T., Kamath, D. and Liddell, H. “Beyond Industrial Decarbonization: Pathways and Challenges to Sustainable Manufacturing,” ACLCA 2023 Conference, September 26-28, 2023, Burlington, Vermont, USA.

Posters

** - Presenter of the poster*

[1] Challa, R.*, Kamath, D. and Anctil, A., “GHG emissions of electric versus combustion vehicles over time in the United States,” Mid-Michigan Symposium for Undergraduate Research Experiences (Mid-SURE), East Lansing, MI, July 2019.

[2] Kamath, D.*, Moore, S., Stephen, T. and Anctil, A., “Modeling availability and cost of repurposed electric vehicle batteries for residential energy storage using a system dynamics approach” Engineering Sustainability 2019, Pittsburgh, PA, April 2019.

[3] Kamath, D.*, Shukla, S. and Anctil, A., “Home charging electric vehicles with second-life EV batteries: Getting every lithium-ion out!” Engineering Graduate Research Symposium, East Lansing, MI, March 2018.

[4] Shukla, S.*, Kamath, D. and Anctil, A., “Power consumption modeling and economic assessment of use of second-life electric vehicle (EV) batteries in microgrids,” Engineering Graduate Research Symposium, East Lansing, MI, March 2018.

[5] Stephen, T.*, Kamath, D. and Anctil, A., “An economic analysis of potential end-of-life pathways for electric vehicle batteries,” Mid-Michigan Symposium for Undergraduate Research Experiences (Mid-SURE), East Lansing, MI, July 2017.

[6] Goss, K.*, Kamath, D. and Anctil, A., “Electric vehicle fast charging station daily power demand profile,” Mid-Michigan Symposium for Undergraduate Research Experiences (Mid-SURE), East Lansing, MI, July 2017.

[7] Xue, S.*, Kamath, D. and Anctil, A., “Environmental impacts of on-road wireless charging versus distributed charging stations,” Mid-Michigan Symposium for Undergraduate Research Experiences (Mid-SURE), East Lansing, MI, July 2017.

[8] Kamath, D.*, Arsenault, R., Kim, HC. and Anctil, A., “Second life potential and environmental benefits of EV batteries as fast charging enablers,” ISIE-ISSST 2017, Chicago, IL, June 2017.

[9] Kamath, D.*, Goss, K., Christy, S. and Anctil, A., “Environmental benefits of second use of EV batteries for fast charging: A life cycle assessment approach,” Engineering Graduate Research Symposium, East Lansing, MI, March 2017.