

Parth Vaishnav

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EDUCATION

Carnegie Mellon University, Pittsburgh, PA

PhD in Engineering and Public Policy (EPP)

May 2015

- Dissertation on reducing air pollution from international aviation and ocean shipping
- Committee: Prof. M. Granger Morgan (CMU), Prof. Paul S. Fischbeck (CMU), Prof. James J. Corbett (University of Delaware), Annie Petsonk (Environmental Defense Fund)
- Coursework in environmental law at Vermont Law School

University of Cambridge, United Kingdom

MPhil in Technology Policy

Jul 2011

- Assessed business models to supply energy to the rural poor; commendation for outstanding performance

National University of Singapore and Eindhoven University of Technology, Netherlands

Master of Technological Design

May 2005

National University of Singapore

Bachelor of Engineering (Mechanical), Minor in Bioengineering

Jun 2003

EXPERIENCE

University of Michigan, Ann Arbor, School for Environment and Sustainability

Assistant Professor of Sustainable Systems, Ann Arbor, MI

Aug 2020 – present

Carnegie Mellon University

Assistant Research Professor, Pittsburgh, PA

Sep 2017 – Jul 2020

Associate Director, Center for Climate and Energy Decision-Making, Pittsburgh, PA

Nov 2015 – Jul 2020

Research Engineer, Pittsburgh, PA

Nov 2015 – Sep 2017

Post-doctoral Fellow, Pittsburgh, PA

Jun 2015 – Oct 2015

Environmental Defense Fund

Aviation Policy Intern, Washington, DC

May 2014 – Aug 2014

- Contributed to improving the International Civil Aviation Organization's (ICAO) scheme to cap carbon dioxide emissions from international aviation by estimating and publishing the impact on airlines of ICAO's proposals
- Played a key role in drafting EDF's comments in support of the U.S. Environmental Protection Agency's endangerment finding for greenhouse gases from aircraft engines [Docket ID No. EPA-HQ-OAR-2014-0828]
- Mentored a graduate recruit, who went on to provide excellent analytical support to the team and is not pursuing a doctorate in economics and law at the University of California, Berkeley

Royal Dutch Shell

Strategy & Portfolio Analyst, The Hague, Netherlands

Apr 2008 – Sep 2010

- Triggered profitable trading decisions through analysis of long- and short-term evolution of market fundamentals for European natural gas and global liquefied natural gas (LNG)
- Provided key inputs to strategic decisions (e.g., whether to invest in gas transmission pipelines) by producing analyses and briefing materials for senior management, including the CEO of Shell

Deployment Analyst, Singapore

Oct 2006 – Mar 2008

- Managed stakeholders across functions and lines of business to improve supply chain planning processes and reduced inventory at Shell Lubricants, Singapore, by 15%

Production Planner, Singapore

Aug 2005 – Oct 2006

- Ensured >95% supply reliability to customers at an industrial lubricant oil plant operating at near-full capacity

National University of Singapore

Research Assistant, Singapore

May 2004 – Aug 2004

- Co-founded a company to commercialize techniques for rapid exploration of product forms

Micron Semiconductor

Undergraduate Intern, Singapore

Jan 2002 – Jun 2002

- Improved process and facility layout to reduce floor space utilization and set-up costs by 40% each

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JOURNAL PUBLICATIONS

Note: In my group, it is standard practice to co-author with students and for students to assume first authorship. Collaboration is strongly encouraged. “+” indicates a PhD student.

1. Vaishnav, P., Implications of Green Technologies for Environmental Justice *Annual Reviews of Environment and Resources*, Forthcoming [Invited paper]
2. Mohan, A.,⁺ Bruchon, M., Michalek, J., Vaishnav, P., Life Cycle Air Pollution, Greenhouse Gas, and Traffic Externality Benefits and Costs of Electrifying Uber and Lyft. *Environmental Science & Technology* [Forthcoming]
3. Woody, M., Vaishnav, P., Craig, M.T. and Keoleian, G.A., 2022. Life Cycle Greenhouse Gas Emissions of the USPS Next-Generation Delivery Vehicle Fleet. *Environmental Science & Technology*, 56(18), pp.13391-13397.
4. Ziev, T.,⁺ Rasouli, E., Tano, I.N., Wu, Z., Rao Yarasi, S., Lamprinakos, N., Seo, J., Narayanan, V., Rollett, A.D. and Vaishnav, P., 2023. Cost of Using Laser Powder Bed Fusion to Fabricate a Molten Salt-to-Supercritical Carbon Dioxide Heat Exchanger for Concentrating Solar Power. *3D Printing and Additive Manufacturing (2023)*. <https://doi.org/10.1089/3dp.2022.0188>
5. Mohan, A.,⁺ Sengupta, S., Vaishnav, P., Tongia, R., Ahmed, A., Azevedo, I.L., 2022. Sustained cost declines in solar PV and battery storage needed to eliminate coal generation in India. *Environ. Res. Lett.* 17, 114043. <https://doi.org/10.1088/1748-9326/ac98d8>
6. Woody, M., Vaishnav, P., Keoleian, G.A., De Kleine, R., Kim, H.C., Anderson, J.E., Wallington, T.J., 2022. Corrigendum: The role of pickup truck electrification in the decarbonization of light-duty vehicles (2022 *Environ. Res. Lett.* 17 034031). *Environmental Research Letters* 17, 089501.
7. Mohan, A.,⁺ Vaishnav, P., 2022. Impact of automation on long haul trucking operator-hours in the United States. *Humanities and Social Science Communications* 9, 1–10. <https://doi.org/10.1057/s41599-022-01103-w>
8. Woody, M., Vaishnav, P., Keoleian, G.A., Kleine, R.D., Kim, H.C., Anderson, J.E., Wallington, T.J., 2022. The role of pickup truck electrification in the decarbonization of light-duty vehicles. *Environ. Res. Lett.* 17, 034031. <https://doi.org/10.1088/1748-9326/ac5142>
9. Tano, I.-N., Rasouli, E., Ziev, T.,⁺ Wu, Z., Lamprinakos, N., Seo, J., Schulze Balhorn, L., Vaishnav, P., Rollett, A., Narayanan, V., 2022. An additively-manufactured molten salt-to-supercritical carbon di-oxide primary heat exchanger for solar thermal power generation – Design and techno-economic performance. *Solar Energy* 234, 152–169. <https://doi.org/10.1016/j.solener.2022.01.056>
10. Woody, M., Craig, M.T., Vaishnav, P.T., Lewis, G.M. and Keoleian, G.A., 2022. Optimizing future cost and emissions of electric delivery vehicles. *Journal of Industrial Ecology*.
11. Deetjen, T.A., Walsh, L., Vaishnav, P., 2021. US residential heat pumps: the private economic potential and its emissions, health, and grid impacts. *Environ. Res. Lett.* 16, 084024. <https://doi.org/10.1088/1748-9326/ac10dc>
 - This article was described in an article in Eos: Rocheleau, J., 2021. Heat Pumps Can Lower Home Emissions, but Not Everywhere. Eos. URL <http://eos.org/articles/heat-pumps-can-lower-home-emissions-but-not-everywhere> (accessed 12.1.21).
12. Woody, M., Vaishnav, P., Craig, M.T., Lewis, G.M., Keoleian, G.A., 2021. Charging Strategies to Minimize Greenhouse Gas Emissions of Electrified Delivery Vehicles. *Environmental Science & Technology* 55, 10108–10120.
13. Lee, J., Marla, L., Vaishnav, P., 2021. The impact of climate change on the recoverability of airline networks. *Transportation Research Part D: Transport and Environment* 95, 102801. <https://doi.org/10.1016/j.trd.2021.102801>

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14. Lathwal P,+ Vaishnav P and Morgan M G 2021 Environmental and health consequences of shore power for vessels calling at major ports in India *Environ. Res. Lett.* Online:
<http://iopscience.iop.org/article/10.1088/1748-9326/abfd5b>
 - This paper was selected as one of the Top 3 by Young Researchers at the May 2021 summit of the OECD's International Transport Forum.
15. Shen, X., Liu, P., Qiu, Y.L., Patwardhan, A. and Vaishnav, P., 2021. Estimation of change in house sales prices in the United States after heat pump adoption. *Nature Energy*, 6(1), pp.30-37.
<https://doi.org/10.1038/s41560-020-00706-4>
16. Roca, J.B.,+ Vaishnav, P., Morgan, G.M., Fuchs, E. and Mendonça, J., 2021. Technology Forgiveness: Why emerging technologies differ in their resilience to institutional instability. *Technological Forecasting and Social Change*, 166, p.120599. <https://doi.org/10.1016/j.techfore.2021.120599>
17. Vaishnav, P., Fatimah, A.M., 2020, "The environmental consequences of electrifying space heating with current and future energy mixes" *Environmental Science & Technology*, 54(16), pp.9814-9823.
<https://doi.org/10.1021/acs.est.0c02705>
18. Mohan, A.,+ Sripad, S., Vaishnav, P., Viswanathan, V., 2020. "Trade-offs between automation and light vehicle electrification" *Nature Energy* 5, 543–549
 - **Notable paper:** This paper explores the question of whether it is possible, in the medium term, to make light vehicles both autonomous and electric. It uses first-principles energy modeling to conclude that the energy penalty associated with automation will likely not exceed 15% of the range of electric vehicles currently on the market. It then advances a series of economic arguments that use customers' revealed preferences to suggest that travelers will value autonomy more than they do this loss of range. The paper won the Herb Toor Award at EPP for Best Qualifier paper for my doctoral student Aniruddh Mohan.
19. Reed, L.,+ Dworkin, M., Vaishnav, P., Morgan, M.G., 2020. "Expanding Transmission Capacity: Examples of Regulatory Paths for Five Alternative Strategies," *The Electricity Journal*, 33(6), p.106770.
20. Funk, P.,+ Davis, A., Vaishnav, P., Dewitt, B., Fuchs, E.R.H., 2020. "Individual inconsistency and aggregate rationality: Overcoming inconsistencies in expert judgment at the technical frontier," *Technological Forecasting and Social Change*, 155, p.119984.
 - Ian Wright, Managing Editor of www.engineering.com produced an eBook entitled, "Should You Use Additive Manufacturing to Produce Your Next Part?" which draws on this research and cites it. Available here: <https://www.engineering.com/ResourceMain.aspx?resid=779>
21. Reed, L.,+ Morgan, M.G., Vaishnav, P., Armanios, D.E., 2019. "Converting existing transmission corridors to HVDC is an overlooked option for increasing transmission capacity." *PNAS* 116, 13879–13884.
<https://doi.org/10.1073/pnas.1905656116>
22. Bonnín Roca, J., Vaishnav, P., Laureijs, R.E., Mendonça, J., Fuchs, E.R.H., 2019. Technology cost drivers for a potential transition to decentralized manufacturing. *Additive Manufacturing* 28, 136–151.
<https://doi.org/10.1016/j.addma.2019.04.010>
23. Abdulla, A., Vaishnav, P., Sergi, B.,+ Victor, D.G., 2019. "Limits to deployment of nuclear power for decarbonization: Insights from public opinion." *Energy Policy* 129, 1339–1346.
<https://doi.org/10.1016/j.enpol.2019.03.039>
 - **Notable paper:** This paper demonstrates an approach to help analysts to estimate the extent to which public fear of a technology might constrain its development. For controversial technologies like nuclear power, modelers typically evaluate two extreme but unrealistic scenarios: one, where the technology is deployed to the extent that is economically optimal, and two, where the controversial technology is completely excluded. We show that it is possible for modelers to improve on this approach by estimating the extent to which a public will allow the deployment of a technology, given the public's anxieties about it.

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24. Hanus, N.L.,+ Wong-Parodi, G., Darghouth, N.R., Vaishnav, P., Azevedo, I.L., 2019. “Solar PV as a mitigation strategy for the U.S. education sector,” *Environmental Research Letters* 14, 044004.
<https://doi.org/10.1088/1748-9326/aafbcf>
25. Kaack, L.H.,+ Vaishnav, P., Morgan, M.G., Azevedo, I.L., Rai, S., 2018. Decarbonizing intraregional freight systems with a focus on modal shift. *Environmental Research Letters*, 13, 083001.
<https://doi.org/10.1088/1748-9326/aad56c>
 - PhD student Lynn Kaack and I were interviewed by Ben Geman, a journalist at *Axios*, who published a summary of the article. The summary quotes both of us: <https://www.axios.com/newsletters/axios-generate-4f68a98a-7c7e-44be-994b-fb10fa461146.html>
 - Selected as Editor’s Featured Article by *Environmental Research Letters*
26. Vaishnav, P., Horner, N., Azevedo, I.L., 2017. “Was it worthwhile? Where have the benefits of rooftop solar photovoltaic generation exceeded the cost?” *Environmental Research Letters*, 12, 094015 doi:10.1088/1748-9326/aa815e
 - **Notable paper:** Provided empirical evidence that subsidies for rooftop solar PV had vastly exceeded their environmental benefits and that policies such as net metering needed to be updated. Selected as Editor’s Featured Article by *Environmental Research Letters* and as a “Highlight of 2017...on the basis of reviewer and Editor endorsement, significance, scientific impact, and breadth of appeal.”
27. Morgan, M.G., Vaishnav, P., Dowlatabadi, H., Azevedo, I.L., 2017. “Rethinking the Social Cost of Carbon” *Issues in Science and Technology*, Summer 33(4): 43-50.
28. Bonnín Roca, J.,+ Vaishnav, P., Morgan, M.G., Mendonça, J., Fuchs, E.R.H., 2017. “When Risks Cannot Be Seen: Regulating Uncertainty in Emerging Technologies” *Research Policy* 46, no. 7 (September 2017): 1215-1233. doi: 10.1016/j.respol.2017.05.010
29. Bonnín Roca, J.,+ Vaishnav, P., Mendonça, J., Morgan, M.G., 2017. “Getting Past the Hype About 3-D Printing” *MIT Sloan Management Review* 58, 57–62 Available: <http://sloanreview.mit.edu/article/getting-past-the-hype-about-3-d-printing/>
 - Beme News, a CNN online channel, featured our research in a short video, “What happened to the 3D printing revolution?” at: <https://www.youtube.com/watch?v=f5fBwppxtkl>
30. Vaishnav, P., 2016. “Design of a Global Market Based Measure □ ICAO’s Market Based Mechanism: Keep It Simple.” *Carbon & Climate Law Review* 10, 120–126. Available: <http://cclr.lexxion.eu/article/CCLR/2016/2/9>
31. Bonnín Roca, J.,+ Vaishnav, P., Fuchs, E.R.H., Morgan, M.G., 2016, “Policy needed for additive manufacturing.” *Nature Materials* 15, 815–818. doi:10.1038/nmat4658
32. Vaishnav, P., Petsonk, A., Avila, R.A.G., Morgan, M.G., Fischbeck, P.S., 2016, “Analysis of a proposed mechanism for carbon-neutral growth in international aviation.” *Transportation Research Part D: Transport and Environment, Special Issue on Climate Change and Transport* 45, 126–138. 10.1016/j.trd.2016.02.017
 - **Notable paper:** This critique demonstrated the need for the International Civil Aviation Organization’s (ICAO) to adopt a simpler strategy than the one outlined in the initial blueprint for ICAO’s mechanism to make airlines offset part of their CO₂ emissions. The study was performed in collaboration with the Environmental Defense Fund, and informed ICAO decisionmakers.
33. Vaishnav, P., Fischbeck, P.S., Morgan, M.G., Corbett, J.J., 2016, “Shore Power for Vessels Calling at U.S. Ports: Benefits and Costs.” *Environmental Science & Technology* 50, no. 3 (February 2, 2016): 1102–10. doi:10.1021/acs.est.5b04860.
34. Vaishnav P., 2014. “Greenhouse gas emissions from international transport.” *Issues in Science and Technology*, Winter 30(2): 25-28. Available: <http://issues.org/30-2/parth/>
35. Vaishnav, P., 2013. “Costs and Benefits of Reducing Fuel Burn and Emissions from Taxiing Aircraft.” *Transportation Research Record: Journal of the Transportation Research Board* 2400 (December): 65–77. doi:10.3141/2400-08.

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OTHER PUBLICATIONS AND WRITINGS

1. Vaishnav, P., Deetjen, T., 2021, Can running an air conditioner in reverse save the planet? Niskanen Center. URL <https://www.niskanencenter.org/can-running-an-air-conditioner-in-reverse-save-the-planet/>
2. Vaishnav, P., Morgan M., Baik, S., Larsen, P., 2019, "Estimating the Value of Enhanced Electric Power Resilience: Case Study of Idaho National Laboratory and a Planned Small Modular Reactor" Report for U.S. Department of Energy Office of Nuclear Energy under Lawrence Berkeley National Laboratory (LBNL) Contract No. DE-AC02-05CH11231
3. Azevedo, I., Horner, N., Siler-Evans, K., Vaishnav, P., 2018. [DATASET] Electricity Marginal Factors Estimates. Climate and Energy Decision Making Center, Carnegie Mellon University.
4. Vaishnav, P., 2016. "Plug the Loopholes in ICAO's Plan." *Aviation Week & Space Technology* 178, 66.
5. Vaishnav, P., Morgan, M.G., 2016. "Summary of a Workshop on Identifying and Avoiding Potential Dead Ends and Missed Opportunities in Climate Policy." Available: <http://cedmcenter.org/wp-content/uploads/2016/06/Summary-of-Workshop-on-Climate-Policy-Dead-Ends-and-Missed-Opportunities.pdf>
6. Vaishnav, P., Abdulla, A., 2016. The Myth of Technology Neutral Regulation. *The Energy Collective*. Available: <https://www.energycentral.com/c/ec/myth-technology-neutral-regulation>
 - This post was mentioned in the testimony of Dr. Edwin Lyman, Senior Scientist, Union of Concerned Scientists Global Security Program, in a hearing of the U.S. Senate Committee on Environment and Public Works on S.2795, "the Nuclear Energy Innovation and Modernization Act." The testimony is available here: https://www.epw.senate.gov/public/?a=Files.Serve&File_id=49C19C65-0886-46FC-AFC7-B944CA7E2E7C
7. Bonnín Roca, J., Vaishnav, P., Fuchs, E.R.H., Morgan, M.G., 2015. "Notes on a Workshop on Certification of Metal Additive Manufacturing Systems and Parts for Use in Civil Aviation: Challenges and Opportunities." Available: http://www.parthv.com/wp-content/uploads/2016/02/CMU_Workshop_Summary_FINAL.pdf
8. Branstetter, L., Horner, N., Morgan, M.G., Rubin, E., Vaishnav, P., 2015. "Put Kids First, Not Gas Companies." *Pittsburgh Post-Gazette*. July 19, sec. Forum.
Reprinted as:
Branstetter, L., Horner, N., Morgan, M.G., Rubin, E., Vaishnav, P., "Put Kids First, Not Gas Companies." *York Dispatch*. July 27, 2015.
9. Vaishnav, P., Horner, N., Branstetter, L., 2015. "Pennsylvania Needs and Can Afford a Shale Gas Severance Tax." *Pittsburgh Post-Gazette*, January 18, sec. Forum.
10. Vaishnav, P. & Horner, N., 2014. "Apocalypse Not: Severance Taxes and Industry Exit in the Marcellus Shale." *Pennsylvania Budget and Policy Center Briefing Paper* Available: <http://tinyurl.com/n8enbtg>
 - We discussed this research extensively with State Senator Art Haywood of Pennsylvania and his staff and participated in hearings about the feasibility of a shale gas severance tax in Pennsylvania.
 - *The Allegheny Front*, a program on local environmental issues, which airs on the local National Public Radio Station (90.5 WESA), featured this work in an article and radio program available here: <http://www.alleghenyfront.org/story/pushing-new-drilling-tax-when-gas-prices-are-low>
11. Vaishnav, P., 2013. "ICAO Deal to (Eventually) Reduce Greenhouse Gas Emissions from Aviation a Good First Step." *The Energy Collective Blog Post*. Available: <https://tinyurl.com/vaishnav-icao-energycollective>
12. Vaishnav, P., 2011. "Innovation for Emerging Markets: Novel Business Models to Supply Energy to the Rural Poor." Dissertation (M.Phil.), University of Cambridge.

CONFERENCE PRESENTATIONS WITH PEER-REVIEWED ABSTRACTS

1. Mohan, A.+ (Speaker), Vaishnav, P., Michalek, J., "Air Pollution, Greenhouse Gas, and Traffic Externality Benefits and Costs of Fully Electrifying Ridesourcing Services" *Transportation Research Board Annual Meeting*, Washington DC, Jan 8-12, 2023

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2. Woody, M. (Presenter), Vaishnav, P., Craig, M., Keoleian, G., “[POSTER] Life-Cycle Greenhouse Gas Emissions of the U.S. Postal Service Next-Generation Delivery Vehicle Fleet,” *Transportation Research Board Annual Meeting*, Washington DC, Jan 8-12, 2023
3. Vaishnav, P. (Speaker), McKenna, C., Gronlund, C., “Equitable Transition to Clean Heating in Cold Climates,” *INFORMS*, Indianapolis, IN, (Oct 2022)
4. McKenna, C. (Speaker), Vaishnav, P., Gronlund, C., “Exploring an equitable transition to clean heating in cold climates,” *US Association of Energy Economics*, Houston, TX, (Oct 2022)
5. McKenna, C. (Speaker), Vaishnav, P., Gronlund, C., Parekh, S., “Addressing an equitable transition to clean heating with empirically validated housing stock improvements for US cold climates,” *ISSST*, Pittsburgh, PA (Jun 2022)
6. Mohan, A., Sengupta, S., Vaishnav, P. (Speaker), Tongia, R., Ahmed, A., Azevedo, I.L., “Analysis of economic conditions needed for solar PV + battery storage to replace coal-powered electricity generation in India,” *ISSST*, Pittsburgh, PA (Jun 2022)
7. Wildstein, P. (Speaker), Craig, M.T., Vaishnav, P., “Quantifying the Impact of Override Behavior on a Summer Direct Load Control Program,” *ISSST*, Pittsburgh, PA (Jun 2022)
8. Mohan, A. (Speaker), Sripad, S., Vaishnav, P., Viswanathan, V., “Trade-Offs Between Automation and Light Vehicle Electrification,” *Transportation Research Board Annual Meeting*, Washington, D.C., (Jan 2022)
9. Mohan, A. (Speaker), Vaishnav, P., “Impact of Automation on Long Haul Trucking Operator Hours in the United States,” *Transportation Research Board Annual Meeting*, Washington, D.C., (Jan 2022)
10. Lathwal, P. (Speaker), Vaishnav, P., Morgan, M.G., “Environmental and Health Consequences of Shore Power for Vessels Calling at Major Ports in India,” *Transportation Research Board Annual Meeting*, Washington, D.C., (Jan 2022)
11. Vaishnav, P. (Virtual Poster Presentation), “Electrifying Heating: Trade-offs between Comfort, Cost, and Electricity Distribution System Load”, AGU Fall Meeting, New Orleans, Dec 2021
12. Aniruddh Mohan, Shayak Sengupta, Parth Vaishnav, Rahul Tongia, Asim Ahmed, “Sustained cost declines in solar PV and battery storage needed to eliminate coal generation in India,” *US Association for Energy Economics*, Virtual (November 2021)
13. Mohan, A. (Speaker), Sripad, S., Vaishnav, P., Viswanathan, V., “Trade-Offs Between Automation and Light Vehicle Electrification,” *US Association for Energy Economics*, Virtual (November 2021)
14. Lathwal, P. (Speaker), Vaishnav, P., Morgan, M.G., “Environmental and Health Consequences of Shore Power for Vessels Calling at Major Ports in India,” *International Symposium on Sustainable Systems and Technology (ISSST)*, Virtual (June 2021)
15. Vaishnav, P. (Speaker), Lathwal, P., Morgan, M.G., “Impacts of Freight Trucking Pollution in the Contiguous United States: Health Damages and Implications for Environmental Justice,” *International Symposium on Sustainable Systems and Technology (ISSST)*, Virtual (June 2021)
16. Deetjen, T. (Speaker), Walsh, L., Vaishnav, P., “U.S. residential heat pumps: the private cost, public benefit, and strategic options for pushing adoption rates beyond 32%,” *39th International Energy Workshop*, June 14 to 17, Virtual (June 2021)
17. Vaishnav, P. (Speaker) and Deetjen, T., “Heat pumps with thermal energy storage: benefits and costs in the U.S.,” *International Symposium on Sustainable Systems and Technology (ISSST)*, Virtual (June 17, 2020)
18. Deetjen, T. (Speaker) and Vaishnav, P., “Heat pumps with thermal energy storage: the cost, peak demand, and emissions impacts of a flexible, electrified heating sector,” *37th United States Association for Energy Economics (USAEE) North American Conference* (Denver, CO, 3-6 Nov. 2019).
19. Mohan, A., Sripad, S., Vaishnav, P., Viswanathan, V. (Speaker), “Automation is no barrier to light vehicle electrification,” *Doctoral Consortium on Computational Sustainability* (Pittsburgh, PA, 18-20 Oct, 2019)

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20. Mohan, A., Sripad, S., Vaishnav, P. (Speaker), Viswanathan, V., "Automation is no barrier to light vehicle electrification," *PA Automated Vehicle Summit* (Pocono Manor, PA, 4-6 Sep, 2019)
21. Vaishnav, P. (Speaker), Fatimah, A.M., "When Should We Electrify Space Heating?", *American Geophysical Union Fall Meeting* (Washington, DC, 10-14 Dec. 2018).
22. Vaishnav, P. (Speaker), Kavakuntala, M., Fatimah, A.M., "When Should We Electrify Space Heating?", *36th United States Association for Energy Economics (USAEE) North American Conference* (Washington, DC, 24-26 Sep. 2018).
23. Kaack, L. (Speaker), Vaishnav, P., Morgan, M.G., Azevedo, I., Rai, S., "Decarbonizing intraregional freight systems with a focus on modal shift", *36th United States Association for Energy Economics (USAEE) North American Conference* (Washington, DC, 24-26 Sep. 2018).
24. Reed, L.B. (Presenter), Morgan, M.G., Vaishnav, P., Armanios, D., "[POSTER] Under What Conditions is HVDC Conversion a Cost-Effective Way to Increase Transmission Capacity in an Existing HVAC Corridor?", *36th United States Association for Energy Economics (USAEE) North American Conference* (Washington, DC, 24-26 Sep. 2018).
 - Won the award for the best poster at the Student Poster Session at the conference
25. Vaishnav, P. (Speaker), Abdulla, A., Sergi, B., Victor, D.G., "Disentangling stigma from actuarial risk: the cautionary story of nuclear power" *Society of Risk Analysis (SRA) 2017 Annual Meeting* (Arlington, VA, 10-14 Dec. 2017).
26. Vaishnav, P. (Speaker), Abdulla, A., Sergi, B., Victor, D., "Disentangling stigma from actuarial risk: the cautionary story of nuclear power" *35th United States Association for Energy Economics (USAEE) North American Conference* (Houston, TX, 12-15 Nov. 2017).
27. Vaishnav, P., Abdulla, A., "[POSTER] Public perceptions of clean energy technologies" *Society of Risk Analysis (SRA) 2016 Annual Meeting* (San Diego, CA, 11-15 Dec. 2016).
28. Bonnín Roca, J. (Speaker), Vaishnav, P. (Speaker), Fuchs, E.R.H., Morgan, M.G., "When Risks Cannot Be Seen: Regulating Uncertainty in Emerging Technologies" *RAPID + TCT* (Pittsburgh, PA, May 8-11, 2017)
29. Vaishnav, P. (Speaker), Horner, N.C., Azevedo, I.L., "Benefit cost and distributional effects analysis for solar PV in the United States" *Society of Risk Analysis (SRA) 2016 Annual Meeting* (San Diego, CA, 11-15 Dec. 2016).
30. Vaishnav, P. (Speaker), Horner, N.C., Azevedo, I.L., "Benefit Cost and Distributional Effects Analysis for Solar PV in the United States" *INFORMS Annual Meeting* (Nashville, TN, 13-16 Nov. 2016).
31. Vaishnav, P. (Speaker), Horner, N.C., Azevedo, I.L., "Location, Location, Location: County-Level Costs and Benefits of Residential Solar Photovoltaics" *34th United States Association for Energy Economics (USAEE) North American Conference* (Tulsa, OK, 23-26 Oct. 2016).
32. Bonnín Roca, J., Vaishnav, P. (Speaker), Fuchs, E.R.H., Morgan, M.G., "How can policymakers help immature technologies cross the 'valley of death'? The case of metallic additive manufacturing for aviation" *4S Annual Meeting* (Denver, CO, 11-14 Nov.)
33. Vaishnav, P. (Speaker), "Analysis of ICAO's Market-based Mechanism: Strawman v1.1." *Technology, Management & Policy (TMP) Graduate Consortium* (Pittsburgh, PA, 21-23 Jun.)
34. Horner N. (Speaker), Vaishnav P., Tisa P. (Speaker), 2014. "Grid Access in Remote Alaska: Evaluating Costs and Benefits." *33rd United States Association for Energy Economics (USAEE) North American Conference* (New York, NY, 15-18 Jun. 2014).
35. Hoss F. (Speaker), Vaishnav P. (Speaker), 2013. "What guides spending on risk mitigation: Perceptions or statistics?" *Society of Risk Analysis (SRA) 2013 Annual Meeting* (Baltimore, MD, 9-11 Dec. 2013).
36. Horner N. (Speaker), Vaishnav P. (Speaker), 2013. "Mitigating Electric Vehicle Impacts on Grid Infrastructure Requirements." *32nd United States Association for Energy Economics (USAEE) North American Conference* (Anchorage, AK, 28-31 Aug. 2013).

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37. Horner N. (Speaker), Vaishnav P. (Speaker), 2012. “Assessment of Pennsylvania Natural Gas Price Support Program Candidates.” *31st United States Association for Energy Economics (USAEE) North American Conference* (Austin, TX, 5 Nov. 2012).
38. Vaishnav, P. (Speaker), 2012. “Low-hanging fruit? The costs and benefits of reducing fuel burn and emissions from taxiing aircraft.” In *12th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference*. Indianapolis, IN: AIAA. Available at: <http://arc.aiaa.org/doi/abs/10.2514/6.2012-5510>.
39. Vaishnav P. (Speaker), 2011. “Innovating for Emerging Markets - The Case of Rural Electrification.” *Technology Management and Policy Graduate Consortium* (University Park, PA, 26-28 Jun. 2011)

LEADERSHIP IN WORKSHOPS AND RESEARCH MEETINGS

1. 2022: Co-organizer, with C. Anna Spurlock (Berkeley Lab / DOE), Burçin Ünel (NYU), Maya Aranoff (NYU), Gabriel Chan (UMN), Diana Hernández (Columbia), Clark Miller (ASU), James Sallee (UC Berkeley), of a conference on Advancing Energy Justice: Tools for Justice40 and Equitable Deep Decarbonization, Virtual, May 11–12, 2022
2. 2017: Co-organizer, with Lynn Kaack and Prof. Granger Morgan, Workshop on Strategies and Opportunities for Decarbonizing the World’s Freight System, supported by the Centre for Climate and Energy Decision-Making at Carnegie Mellon University, Pittsburgh, PA
3. 2016: Co-organizer, with Prof. Granger Morgan, Workshop on Identifying and Avoiding Potential Dead Ends and Missed Opportunities in Climate Policy, supported by the Centre for Climate and Energy Decision-Making in Washington, DC

STUDENTS ADVISED

Current PhD students

At the University of Michigan

1. Mallika Kothari, Fall 2023—
2. Peter Fabe (with Prof. Daniel Cooper of Mechanical Engineering), Fall 2023—
3. Pamela Wildstein (with Prof. Michael Craig), “Reliability Contribution of Residential Dynamic Rates,” Fall 2022—
4. Jiahui Chen, “EV-building integration as a decarbonization strategy for a changing grid,” Fall 2022—
5. Shuhaib Nawawi, “Assessing how different energy storage methods in residential buildings affect the trade-offs between flexible heating demand, power sector emissions, and occupant comfort,” Fall 2022—
6. Claire McKenna, “Heating with justice,” Fall 2021—

At Carnegie Mellon University

7. Jordan Joseph (with Prof. Destenie Nock, Prof. Kelvin Gregory, and Prof. Costa Samaras), Fall 2023—
8. Tracey Ziev, “Techno-economic analysis of additively manufactured heat exchangers”, Fall 2019
 - Tracey won CMU EPP’s Herb Toor Award for best qualifying paper in 2021

Graduated PhD students

9. Aniruddh Mohan (co-advised with Prof. Venkat Viswanathan of CMU Mechanical Engineering), “Technology and policy problems related to the electrification of transport,” Fall 2018—Summer 2022, Distinguished Postdoctoral Fellow, Andlinger Center for Energy and the Environment, Princeton University
 - Aniruddh will defend his dissertation in June 2022, and in July 2022 begin an appointment as a Distinguished Postdoctoral Fellow at the Andlinger Center at Princeton University
 - Aniruddh won CMU EPP’s Herb Toor Award for best qualifying paper in 2020
 - Aniruddh was awarded a Carnegie Mellon Presidential Fellowship, covering tuition and stipend, for AY2019-20 on my nomination

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10. Priyank Lathwal (co-advised with EPP Prof. Granger Morgan), “Benefits and costs of shore power in India,” Summer 2018—Fall 2021, Young Professional, Transport Global Practice, The World Bank Group
11. Jihoon Shin (co-advised with EPP Prof. Granger Morgan, Dr. Ana Barros (University of Porto), Dr. Miguel Amaral (University of Lisbon)), “Exploring opportunities for Portugal to join the supply chain for outfitting aircraft cabin interiors (ACI),” Fall 2016—Spring 2022. Jihoon is on the job market
12. Elizabeth Reed (co-advised with EPP Prof. Granger Morgan and Prof. Daniel Armanios), “Assessing High Voltage Direct Current (HVDC) as an enabling technology for deep decarbonization of the electricity grid” Fall 2016—Fall 2020 Liza now works for the Niskanen Center as the research manager for low carbon technology policy
13. Patrick Funk (co-advised with EPP Prof. Erica Fuchs and Prof. Alex Davis), “Discovering the heuristics of additive manufacturing,” Fall 2016—Fall 2019 Patrick now works at the Food and Drug Administration
14. Jaime Bonnín Roca (co-advised with EPP Prof. Erica Fuchs, Prof. Granger Morgan, and Dr. Joana Mendonça (University of Lisbon)), “Leaders and followers: challenges and opportunities in the adoption of metal additive manufacturing technologies,” Fall 2017. Jaime was a postdoctoral researcher at the Institute for Manufacturing at the University of Cambridge and has begun an appointment as a tenure-track assistant professor at Eindhoven University of Technology in January 2019.

Postdoctoral researchers

1. Ming Yi (lead advisor, with Prof. Michael Craig) April 2023-June 2023
2. Thomas Deetjen (lead advisor, co-advised with Prof. Inês Azevedo and Prof. Costa Samaras) May 2019—Spring 2020
3. Sunhee Baik (co-advisor with Prof. Granger Morgan and Prof. Alex Davis) April 2019—June 2019

Master’s students

At the University of Michigan

1. Lanzhao Cheng, “How do distributed energy resources change the economics of decarbonization,” Fall 2022—
2. Shagun Parekh, “Heating with Justice,” Fall 2022—
3. Yizhou Tian, “The carbon footprint of automated freight,” Fall 2022—
4. Moksha Menghaney, Tianyi Zhang, Rishi Madethatt (with Prof. Carina Gronlund of ISR), “Literature Review on Infrastructure Interdependencies,” Winter 2022
5. Pamela Wildstein (with Prof. Michael Craig), “Quantifying demand response,” Winter 2021—Summer 2022
6. Sofia Camarero (with Prof. Jose Alfaro), “Trade off analysis between biochar and syngas in gasification of hemp agricultural wastes in the midwest of the United States,” Winter 2021—Winter 2022
7. Maxwell Woody (with Prof. Greg Keoleian, Prof. Michael Craig, and Dr. Geoffrey Lewis), “Minimizing GHG Emissions from an Electrified Delivery Fleet,” Fall 2020—

At Carnegie Mellon University

8. Pranav Gupta (with Dr. Aranya Venkatesh and Prof. Paulina Jaramillo), “Air conditioning in the global South,” Fall 2020—Fall 2021
9. Jasmine Lim (with Prof. Paulina Jaramillo), “Air conditioning in the global South,” Fall 2019
10. Aradhana Gahlaut, “Climate change-related disruptions to the U.S. air system,” Fall 2018 and Spring 2019
11. Meghana Kavakuntala, “Electrification of heating in the United States – accounting for a changed climate,” Spring 2018
12. Adilla Mutia Fatimah, “Electrification of heating in the United States,” Fall 2017
13. Srijana Rai (with EPP PhD student Lynn Kaack), “Decarbonizing Global Freight Systems with a Focus on Modal Shift,” Fall 2017

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14. Courtney Thier, Yichen Wei, Tania Lopez, “Updating a tool to analyze the cost and environmental impacts of user-defined electricity portfolios for Pennsylvania,” Fall 2015

Undergraduates

At the University of Michigan

1. Shagun Parekh, “Heating with Justice,” Spring 2021—
2. Yizhou Tian, “The carbon footprint of automated freight,” Summer 2021

At Carnegie Mellon University

1. Frank Andujar Lugo (with Prof. Paulina Jaramillo), “Air conditioning in the global South,” Fall 2019—Spring 2020
2. Liam Walsh (with Dr. Thomas Deegen), “Assessing the Value of Flexible Electric Heating,” Summer 2019—
3. Krishna Dave, “Airline data for forecasting future airline emissions” Spring 2018
4. Olamitundun Oladipo (with EPP Prof. Alex Davis and Prof. Tamar Krishnamurti (University of Pittsburgh)), “It's what you know that just ain't so: Countering misinformation,” Fall 2017
5. Krishna Dave (with EPP PhD student Jaime Bonnin Roca), “Willingness to pay for reduced lead times in aviation supply chains,” Fall 2017
6. Cheyenne Shankle, “Identifying proposed new technologies to improve commercial aircraft fuel efficiency,” Spring 2016

PhD THESIS COMMITTEE SERVICE

1. Sean Smillie (with Prof. Jay Apt, Prof. Granger Morgan of Carnegie Mellon and Dr. Gerard Freeman of the Pacific Northwest National Lab), “Challenges at the interface of the natural gas and electric systems,” Fall 2023—
2. Yuchuan Lai (with Civil & Environmental Engineering, CMU, with Prof. David Dzombak, Prof. Jared Cohon, and Prof. Constantine Samaras), “Use of historical data to assess and forecast regional climate change,” Fall 2018—Fall 2020
3. Lynn Kaack (with Prof. Granger Morgan, Prof. Jay Apt, Prof. Inês Azevedo, and Prof. Patrick McSharry), “Challenges and Prospects for Data-Driven Climate Change Mitigation,” Spring 2018—Spring 2019
4. Kerim Dickson (Civil & Environmental Engineering, CMU, with Prof. David Dzombak, Prof. Jared Cohon, and Prof. Constantine Samaras), “Interbasin Transfers in the United States: Present and Future,” Fall 2016—Fall 2018 (when Kerim graduated).

PhD QUALIFIER COMMITTEE SERVICE

1. Woo Suk Chun (Civil & Environmental Engineering, CMU), Fall 2017
2. Tania Lopez (Civil & Environmental Engineering, CMU), Fall 2017
3. Jiaan Wang (Civil & Environmental Engineering, CMU), Fall 2017
4. Yuchuan Lai (Civil & Environmental Engineering, CMU), Fall 2017
5. Miranda Gorman (Civil & Environmental Engineering, CMU), Fall 2016

EDUCATIONAL CONTRIBUTIONS

Courses taught as instructor

At the University of Michigan

- EAS610: Advanced Life Cycle Assessment

Faculty course evaluations:

(2021, n = 10 out of 19 enrolled) 4.7/5 for overall course quality and 4.9/5 for quality of teaching

(2022, n = 19 out of 28 enrolled) 4.4/5 for overall course quality and 4.8/5 for quality of teaching

(2023, n = 10 out of 34 enrolled) 4.5/5 for overall course quality and 4.7/5 for quality of teaching

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- EAS580: Sustainable Transportation
Faculty course evaluations:
(2021, n = 9 out of 14 enrolled) 4.8/5 for overall course quality and 4.9/5 for quality of teaching
(2022, n = 5 out of 9 enrolled) 4.9/5 for overall course quality and 4.9/5 for quality of teaching
(2023, n = 20 out of 27 enrolled) 4.7/5 for overall course quality and 4.8/5 for quality of teaching
- EAS551: Climate Change Science and Solutions
Faculty course evaluations:
(2021, n = 18 out of 22 enrolled) 4.8/5 for overall course quality and 5/5 for quality of teaching
(2021, n = 22 out of 43 enrolled) 4.6/5 for overall course quality and 4.8/5 for quality of teaching

At Carnegie Mellon University

- Climate Change Science and Adaptation:
Faculty course evaluations:
(2018, n = 8) 4.4/5 for overall course quality and 4.6/5 for quality of teaching
(2017, n = 17) 4.5/5 for overall course quality and 4.5/5 for quality of teaching
(2016, n = 20) 4.5/5 for overall course quality and 4.6/5 for quality of teaching

Guest lectures

- *Communicating with journalists about climate solutions*, Environmental Journalism: Reporting About Science, Policy and Public Health by Julie Halpert, University of Michigan, in Fall 2022 and Winter 2023
- *Electrify everything? Case studies in electrification in the real world* in a PhD seminar on Advanced Science, Technology, and Innovation Policy by Prof. Gang He, Stony Brook University in Winter 2023
- *Climate Change: Problems and Solutions* in a graduate course on Managing Emergencies and Disasters by Miriam Belblidia, interim director, Center for Disaster Management, University of Pittsburgh
- *Resilience and Asset Management* in a graduate course on Infrastructure Management by Prof. Don Coffelt and Prof. Sean Qian in Spring 2018
- *Understanding Electricity Mix Trade-offs* in a graduate course on Environmental Politics & Policy by Prof. Deborah Stine in Spring 2017 and Fall 2017
- *Climate Change: Problems and Solutions* in a graduate course on Energy Conversion and Supply by Prof. Yoosuf Picard in Fall 2016

Service as teaching assistant at Carnegie Mellon University

- *Introduction to the Theory and Practice of Policy Analysis* (Fall 2014), taught by Prof. Granger Morgan and Prof. Inês Azevedo. Responsibilities included assessment and providing written feedback on assignments and exams, helping design exams, and holding three hour-long recitation sessions.
- *Introduction to Engineering and Public Policy* (Spring 2014), taught by Prof. Marvin Sirbu. Designed and held weekly recitation sessions for a group of 20 students to reinforce and clarify concepts taught in class, as well as weekly office hours. Assisted in the design and assessment of examinations and assignments.

Educational outreach

- *Engineer Your World*: Instructor for CMU's Gelfand Center's summer outreach program for children in middle school. I provided 15 hours of classroom instruction and activities on green engineering and environmental life-cycle assessment for a class of 14 students. July 23-27, 2018. More here: <https://www.cmu.edu/gelfand/gelfand-outreach/summer-classes.html>
- *Summer Centre for Climate and Energy Decision-making (SUCCEED)*: I lead a group of PhD students to organize a five-day summer workshop to teach high school students about issues relating to energy and the

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environment. This is followed by a two-day workshop for high school teachers covering the same topic. I teach in the workshop for teachers. More here: <https://cedmcenter.org/succeed/>

Professional training

- *Trainer for new supply chain planning processes and tools:* In 2007, at Shell Singapore, provided 50 hours of classroom training in demand planning, production planning, and supply network planning processes and an enterprise resource planning tool to implement the new processes. Training recipients included plant operators, planners, and supply chain managers.

GRANTS

Dates	Title	Awarding body	Role	Value
Oct 2022 – Sep 2025	Enabling Micro-pin Array Receivers for Power Generation and High-temperature Process Heating Using Metal Additive Manufacturing	U.S. Department of Energy	co-PI	\$4.6 million (including \$357k federal share to support a PhD student and 1 month of my salary for 3 years)
Jun 2022 – May 2023	Bold Challenges Nurture Phase	University of Michigan OVRP	PI	\$50,000
Jan 2022 – May 2022	Bold Challenges Incubation Phase	University of Michigan OVRP	PI	\$25,000
April 2022 – March 2024	EV-building integration as a decarbonization strategy for a changing grid	Ford – Michigan – Ann Arbor Alliance	PI	\$200,000
Oct 2020 – Aug 2021	Affordable Near- and Medium-Term Solutions for Integration of Low GWP Heat Pumps in Residential Buildings	California Energy Commission	Consultant	\$12,000
Mar 2021 – Feb 2023	Heating with Justice: How can we make electrified space heating equitable?	Graham Sustainability Institute, University of Michigan	PI	\$300,000
Sep 2020 – Aug 2022	The Effect of Ride Hailing on Energy Use, the Environment, and on Equity	Scott Institute for Energy Innovation	PI	\$75,000
Sep 2019 – Aug 2020	What new jobs might autonomous trucking create?	Block Center for Technology & Society	PI	\$75,000 (1yr of support for EPP PhD student Aniruddh Mohan)
Apr 2019 – Jun 2019	Estimating the Value of Enhanced Electric Power Resilience	Lawrence Berkeley National Laboratory	Co-PI	\$96,818 (2.5 months of support for me)
Apr 2019 – Apr 2021	Realizing the full value of flexible electric heating	The Alfred P. Sloan Foundation	PI, with Prof. Lucy Qui of UMD	\$300,000 (\$150k for CMU; \$150k for University)

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Dates	Title	Awarding body	Role	Value
				of Maryland, UMD)
Jul 2019— Jun 2022	High Intensity Thermal Exchange through Materials, and Manufacturing Processes (HITEMMP)	Advanced Research Projects Agency-Energy (ARPA-E), U.S. Department of Energy	Co-PI	\$2,400,000 (including ~\$75k to support a PhD student for one year and provide 3 months' salary support for me.)
Apr 2019— Mar 2022	Additively-Manufactured Molten Salt-to-Supercritical Carbon Dioxide Heat Exchanger	U.S. Department of Energy	Co-PI	\$2,400,000 (including \$260k in support for a PhD student I will advise and 3 months' salary support for me)
Sep 2018 — Aug 2019	Accelerating MAM Commercialization and Military Readiness: Expert guided machine learning to identify candidate parts and subassemblies for additive manufacturing	Manufacturing Futures Initiative, CMU	Co-PI	\$177,779
Jul 2018 — Dec 2019	To analyze the challenges and opportunities associated with upgrading and transforming high voltage transmission lines as compared with citing new transmission infrastructure	The Alfred P. Sloan Foundation	Co-PI	\$165,000
May 2018	AI for Earth Microsoft Azure Grant for PhD student Lynn Kaack	Microsoft	Faculty Advisor	\$5,000
Sep 2017— Aug 2018	Identifying Product Opportunities: Expert heuristics in scientific decision-making	Manufacturing Futures Initiative, CMU	Co-PI	\$107,091
Fall 2015	Equipment purchase grant to support experiential learning for high-school students participating in SUCCEED (SUMmer Center or Climate Energy and Environmental Decision-making)	ProSEED / Crosswalk Seed Grants, CMU	PI	\$2,500
Oct 2012— Sep 2013	Low-Hanging Fruit? The Costs and Benefits of Reducing Fuel Burn and Emissions from Taxiing Aircraft	Transportation Research Board, U.S. National Academy of Sciences	PI	\$10,000

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INVITED TALKS

1. "Emissions from Heating and Cooling: Energy Sources and Uses," Weimer School of Advanced Studies in Real Estate and Land Economics, The Hoyt Institute, May 19-20, 2023, West Palm Beach, Florida
2. "Real-world insights on the effect of electrification on energy burdens," Green Home Institute, May 1, online: <https://www.youtube.com/watch?v=y9QflmV0rnl> (>150 live attendees)
3. "Equity, Behavior, and Electrification: Case Studies from the Residential and Power Sectors," Basic Research Needs to Understand the Human Dimensions of Energy Systems Workshop at the National Renewable Energy Laboratory, Golden, CO, September 6-7, 2022
4. "Heating with Justice," at the Graham Sustainability Institute, April 5, 2022
5. "The consequences of electrification for air pollution," at the Chinese Society for Industrial Ecology, Nov 8, 2021. Available here: <https://www.bilibili.com/video/BV1Cb4y187Mo>
6. "Clean Energy Conversation focused on the intersection of infrastructure transformation and Equity," at the Graham Sustainability Institute, University of Michigan, February 23, 2021
7. "Do Heat pumps Save Energy and Increase Home Value?" (with Prof. Lucy Qiu at the University of Maryland), at the Green Home Institute, January 21, 2021. Available: https://www.youtube.com/watch?v=67_FE6k9X_A
8. "Trade-offs between automation and light vehicle electrification" at the Finland - Michigan Energy Circle Collaboration Toward Electrification, Nov 12, 2020
9. "Vehicles: Efficiency and Electrification" at the Virtual Workshop on a Circular Carbon Economy organized by the Center on Global Energy Policy at Columbia University and the Global CCS Institute, October 27, 2020
10. "Electrify everything? Two case studies" at NEW Energy: Conversations with Early Career Energy Researchers organized by the Irving Institute for Energy and Society at Dartmouth College, July 1, 2020. Available: <https://www.youtube.com/watch?v=FAi5I9ANPZ8>
11. "Electrification in the real world: can autonomous vehicles be electric?" at School for Environment and Sustainability, University of Michigan, February 18, 2020
12. "Engineering to reduce transport greenhouse gas emissions: Autonomous electric vehicles and distributed additive manufacturing" at Department of Mechanical and Aerospace Engineering, University of California San Diego, Feb 27, 2019.
13. "The Consequences of Decarbonization Strategies for Equity" at the School of Global Policy and Strategy, University of California San Diego, Feb 28, 2019.
14. "Additive manufacturing: economics and challenges to adoption" delivered as a webinar to the Lawrence Livermore National Laboratory, Feb 1, 2019.
15. "What can government do to support the deployment of an emerging technology?" at AED Days 2018, Oeiras, Portugal, Nov 21, 2018.
16. "How might 3D printing change manufacturing practice and supply chains?" at the Institute for Manufacturing, University of Cambridge, Mar 15, 2018.
17. "Is the sky the limit: can we decarbonize civil aviation?" at the Deep Decarbonization Initiative (D2I), Laboratory on International Law & Regulation (ILAR), University of California San Diego, Nov 29, 2017.

AWARDS

- 2022: Outstanding student paper award at the ASME Energy Sustainability Conference in July 2022 for "A Scalable Compact Additively-Manufactured Molten-Salt to Supercritical CO₂ Heat Exchanger for Solar Thermal Application." The paper was led by Ines-Noelly Tano of UC Davis; my doctoral student Tracey Ziev and I contributed to the techno-economic analysis performed in the paper.
- 2021: "The Environmental Consequences of Electrifying Space Heating", published in Environmental Science & Technology in 2020, has been chosen as the second runner up of the ES&T Best Paper Award for Best Policy Article in 2020

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- 2019: “Decarbonizing intraregional freight systems with a focus on modal shift” was selected as Editor’s Featured Article by *Environmental Research Letters*.
- 2018: “Was it worthwhile? Where have the benefits of rooftop solar photovoltaic generation exceeded the cost?” was selected as Editor’s Featured Article by *Environmental Research Letters* and as a “Highlight of 2017...on the basis of reviewer and Editor endorsement, significance, scientific impact, and breadth of appeal.”
- 2013: Third prize (team) at the US Association of Energy Economics’ (USAEE) Case Competition at the USAEE’s 32nd North American Conference, Anchorage, AK
- 2012: Second prize (team) at USAEE’s Case Competition at the 31st North American Conference, Austin, TX
- 2011: Letter of commendation for outstanding performance in the MPhil by the University of Cambridge
- 2011: Hughes Hall Scholarship covering tuition fees associated with pursuing a PhD at the University of Cambridge. Each year, only one student at Hughes Hall is offered this award.
- 2009: Vice President’s award from Shell Energy Europe (SEE) for work on modeling the impact of the 2009 recession in Europe on natural gas demand. The awards were presented to up to three people each quarter, from SEE’s staff of about 500.
- 2008: Vice President’s award from SEE for work on the identification of potential bottlenecks in Europe’s gas transmission pipeline system
- 1999: SIA-NOL Scholarship, covering all expenses for undergraduate studies at the National University of Singapore, by the Government of Singapore. About 1% of applicants were successful
- 1997: National Talent Search Scholarship by the Government of India. Less than 1% of applicants were successful

SERVICE ACTIVITIES

At University of Michigan

- Search committee for Assistant Professor in the Sustainable Systems specialization, Winter 2023

At Carnegie Mellon University

- Graduate Student Ombudsperson, Department of Engineering & Public Policy, Carnegie Mellon University, Fall 2019—Fall 2020
- Chair, USAEE Case Competition. Leading a team to write the case, liaise with sponsors, publicize the competition to ensure wide participation, and to organize judging of entries. The cases are available here: <http://www.parthv.com/usaee-cases/> (2016—2019)
- Committee service at the Department of Engineering & Public Policy, Carnegie Mellon University
 - 2018—Graduate curriculum committee
 - 2018—Part B qualifier committee
 - 2018—Energy and environment area co-chair (with Prof. Haibo Zhai)
 - 2018—Committee on culture and well-being
- Executive Editorial Board, *Environmental Research: Energy*, Institute of Physics
- Editorial Board, *Renewable and Sustainable Energy Transition*, Elsevier
- Ad-hoc reviewer for *Nature*, *Nature Energy*, *Nature Climate Change*, *Joule*, *Proceedings of the National Academy of Sciences (PNAS)*, *Environmental Research Letters*, *Energy Policy*, *Transportation Research Part C: Emerging Technologies*, *Transportation Research Part D: Transport and Environment* and *Energy Journal*,
- Peer reviewer for a study commissioned by the Asian Development Bank (ADB) on Technological Transformation in Indonesia

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- Conference abstract reviewer for US Association of Energy Economics Annual Meeting (2017, 2018)
- Co-wrote, with Prof. Eric Hittinger of the Rochester Institute of Technology, the problem for the US Association of Energy Economists (USAEE) Case Competition (2015)

LANGUAGES

- English — native proficiency
- German — basic proficiency
- Hindi — intermediate proficiency
- Gujarati — intermediate proficiency
- Marathi — basic proficiency