Stanford

Inês M.L. Azevedo

Associate Professor of Energy Resources Engineering and Senior Fellow at the Woods Institute for the Environment

Bio

BIO

Professor Azevedo is passionate about solving problems that include environmental, technical, economic, and policy issues, where traditional engineering approaches play an important role but cannot provide a complete answer. In particular, she is interested in assessing how energy systems are likely to evolve, which requires comprehensive knowledge of the technologies that can address future energy needs and the decision-making process followed by various agents in the economy.

ACADEMIC APPOINTMENTS

- Associate Professor, Energy Resources Engineering
- Senior Fellow, Stanford Woods Institute for the Environment

ADMINISTRATIVE APPOINTMENTS

- Professor, Carnegie Mellon University, (2013-2019)
- Co-Director, Climate and Energy Decision Making (CEDM) Center, (2013- present)
- Associate Professor, Energy Resources Engineering, (2019- present)

HONORS AND AWARDS

- C3E Women in Clean Energy, Research Award, C3E (2017)
- Philip L. Dowd Fellowship Award, Carnegie Mellon University (2017)
- Emerging Female Scientist Award (Honorable Mention), Carnegie Science (2016)
- "Young Scientists Under 40, World Economic Forum (WEF) (2014)
- CIT Dean’s Early Career Fellowship, Carnegie Mellon University (2013)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Council Member, United States Association for Energy Economics (2016 - present)
- Board member, Pecan Street Research Data Board (2013 - present)

PROFESSIONAL EDUCATION

- Ph.D., Carnegie Mellon University , Engineering and Public Policy (2009)
- M.Sc., IST Technical University of Lisbon , Innovation and Management of Technology (2009)
- B.Sc., IST Technical University of Lisbon , Environmental Engineering (2004)

LINKS

- Curriculum Vitae PDF: https://ines.stanford.edu/sites/g/files/sbiybj10551/f/azevedo_cv_august_2019.pdf

- Azevedo Research: https://earth.stanford.edu/ere/about/energy-resources-engineering-faculty#gs.wtgaez
- Interdisciplinary Energy Systems (INES) Research Group: https://ines.stanford.edu/
- Google Scholar: https://scholar.google.com/citations?user=f2yeR2QAAAAJ&hl=en&oi=ao

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Professor Azevedo is passionate about solving problems that include environmental, technical, economic, and policy issues, where traditional engineering approaches play an important role but cannot provide a complete answer. In particular, she is interested in assessing how energy systems are likely to evolve, which requires comprehensive knowledge of the technologies that can address future energy needs and the decision-making process followed by various agents in the economy.

Teaching

COURSES

2019-20

- ERE Master's Graduate Seminar: ENERGY 351 (Spr)
- ERE PhD Graduate Seminar: ENERGY 352 (Spr)
- Introduction to Quantitative Methods for Energy Decisions: ENERGY 263 (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Jingfan Wang

Doctoral (Program)

Tapas Peshin, Madalsa Singh

Publications

PUBLICATIONS

- **Fine particulate matter damages and value added in the US economy.** *Proceedings of the National Academy of Sciences of the United States of America*
  Tschofen, P., Azevedo, I. L., Muller, N. Z.
  2019
- **How Much Are We Saving after All? Characterizing the Effects of Commonly Varying Assumptions on Emissions and Damage Estimates in PJM.** *Environmental science & technology*
  Donti, P. L., Kolter, J. Z., Azevedo, I. L.
  2019
- **Choice at the pump: measuring preferences for lower-carbon combustion fuels** *ENVIRONMENTAL RESEARCH LETTERS*
  Helveston, J. P., Seki, S. M., Min, J., Fairman, E., Boni, A. A., Michalek, J. J., Azevedo, I. L.
  2019; 14 (8)
- **Alternative-fuel-vehicle policy interactions increase US greenhouse gas emissions** *TRANSPORTATION RESEARCH PART A-POLICY AND PRACTICE*
  Jenn, A., Azevedo, I. L., Michalek, J. J.
  2019; 124: 396–407
- **Trace Element Mass Flow Rates from US Coal Fired Power Plants** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Sun, X., Gingerich, D. B., Azevedo, I. L., Mauter, M. S.
  2019; 53 (10): 5585–95
- **Support for Emissions Reductions Based on Immediate and Long-term Pollution Exposure in China** *ECOLOGICAL ECONOMICS*

Sergi, B., Azevedo, I., Xia, T., Davis, A., Xu, J.
2019; 158: 26–33

- **Solar PV as a mitigation strategy for the US education sector** *ENVIRONMENTAL RESEARCH LETTERS*
  Hanus, N. L., Wong-Parodi, G., Vaishnav, P. T., Darghouth, N. R., Azevedo, I. L.
  2019; 14 (4)
- **Expert assessments of the cost and expected future performance of proton exchange membrane fuel cells for vehicles** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Whiston, M. M., Azevedo, I. L., Litster, S., Whitefoot, K. S., Samaras, C., Whitacre, J. F.
  2019; 116 (11): 4899–4904
- **Economic Viability of a Natural Gas Refueling Infrastructure for Long-Haul Trucks** *JOURNAL OF INFRASTRUCTURE SYSTEMS*
  Tong, F., Azevedo, I., Jaramillo, P.
  2019; 25 (1)
- **Understanding Cumulative Risk Perception from Judgments and Choices: An Application to Flood Risks** *RISK ANALYSIS*
  De La Maza, C., Davis, A., Gonzalez, C., Azevedo, I.
  2019; 39 (2): 488–504
- **Reducing the Fuel Consumption and Greenhouse Gas Emissions of Medium- and Heavy-Duty Vehicles, Phase Two**
  Research Council, N.
  The National Academies Press. Washington, DC.
  2019
- **Reduced-Order Dispatch Model for Simulating Marginal Emissions Factors for the United States Power Sector.** *Environmental science & technology*
  Deetjen, T. A., Azevedo, I. L.
  2019
- **Meeting U.S. Solid Oxide Fuel Cell Targets** *Joule*
  Whiston, M. M.
  2019
- **The implications of scope and boundary choice on the establishment and success of metropolitan greenhouse gas reduction targets in the United States** *ENVIRONMENTAL RESEARCH LETTERS*
  Markolf, S. A., Matthews, H., Azevedo, I. L., Hendrickson, C.
  2018; 13 (12)
- **Global carbon intensity of crude oil production.** *Science (New York, N.Y.)*
  Masnadi, M. S., El-Houjeiri, H. M., Schunack, D., Li, Y., Englander, J. G., Badahdah, A., Monfort, J., Anderson, J. E., Wallington, T. J., Bergerson, J. A., Gordon, D., Koomey, J., Przesmitzki, et al
  2018; 361 (6405): 851–53
- **Decarbonizing intraregional freight systems with a focus on modal shift** *ENVIRONMENTAL RESEARCH LETTERS*
  Kaack, L. H., Vaishnav, P., Morgan, M., Azevedo, I. L., Rai, S.
  2018; 13 (8)
- **Expert assessments on the future of direct current in buildings** *ENVIRONMENTAL RESEARCH LETTERS*
  Glasgo, B., Azevedo, I., Hendrickson, C.
  2018; 13 (7)
- **Net-zero emissions energy systems** *SCIENCE*
  Davis, S. J., Lewis, N. S., Shaner, M., Aggarwal, S., Arent, D., Azevedo, I. L., Benson, S. M., Bradley, T., Brouwer, J., Chiang, Y., Clack, C. M., Cohen, A., Doig, et al
  2018; 360 (6396): 1419-+
- **Assessing the evolution of power sector carbon intensity in the United States** *ENVIRONMENTAL RESEARCH LETTERS*
  Schivley, G., Azevedo, I., Samaras, C.
  2018; 13 (6)
- **Estimation of the year-on-year volatility and the unpredictability of the United States energy system** *NATURE ENERGY*

Sherwin, E. D., Henrion, M., Azevedo, I. L.
2018; 3 (4): 341–46

- **Towards demand-side solutions for mitigating climate change** *NATURE CLIMATE CHANGE*
  Creutzig, F., Roy, J., Lamb, W. F., Azevedo, I. L., de Bruin, W., Dalkmann, H., Edelenbosch, O. Y., Geels, F. W., Grubler, A., Hepburn, C., Hertwich, E. G., Khosla, R., Mattauch, et al
  2018; 8 (4): 268–71

- **A sunny future: expert elicitation of China's solar photovoltaic technologies** *ENVIRONMENTAL RESEARCH LETTERS*
  Lam, L. T., Branstetter, L., Azevedo, I. L.
  2018; 13 (3)

- **Induced seismicity hazard and risk by enhanced geothermal systems: an expert elicitation approach** *ENVIRONMENTAL RESEARCH LETTERS*
  Trutnevyte, E., Azevedo, I. L.
  2018; 13 (3)

- **Consumers' perceptions of energy use and energy savings: A literature review** *ENVIRONMENTAL RESEARCH LETTERS*
  Lesic, V., de Bruin, W., Davis, M. C., Krishnamurti, T., Azevedo, I. L.
  2018; 13 (3)

- **Quantifying the capacity value of natural gas efficiency in New England** *UTILITIES POLICY*
  Gilbraith, N., Jaramillo, P., Azevedo, I.
  2018; 50: 101–10

- **Distributional costs of wind energy production in Portugal under the liberalized Iberian market regime** *ENERGY POLICY*
  Prata, R., Carvalho, P. S., Azevedo, I. L.
  2018; 113: 500–512

- **Do tidal stream energy projects offer more value than offshore wind farms? A case study in the United Kingdom** *ENERGY POLICY*
  Lamy, J. V., Azevedo, I. L.
  2018; 113: 28–40

- **The effect of providing climate and health information on support for alternative electricity portfolios** *ENVIRONMENTAL RESEARCH LETTERS*
  Sergi, B., Davis, A., Azevedo, I.
  2018; 13 (2)

- **Marginal Emissions Factors for Electricity Generation in the Midcontinent ISO** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Thind, M. S., Wilson, E. J., Azevedo, I. L., Marshall, J. D.
  2017; 51 (24): 14445–52

- **Estimating the Quantity of Wind and Solar Required To Displace Storage-Induced Emissions** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Hittinger, E., Azevedo, I. L.
  2017; 51 (21): 12988–97

- **Assessing the value of information in residential building simulation: Comparing simulated and actual building loads at the circuit level** *APPLIED ENERGY*
  Glasgo, B., Hendrickson, C., Azevedo, I.
  2017; 203: 348–63

- **Was it worthwhile? Where have the benefits of rooftop solar photovoltaic generation exceeded the cost?** *ENVIRONMENTAL RESEARCH LETTERS*
  Vaishnav, P., Horner, N., Azevedo, I. L.
  2017; 12 (9)

- **China's wind industry: Leading in deployment, lagging in innovation** *ENERGY POLICY*
  Lam, L. T., Branstetter, L., Azevedo, I. L.
  2017; 106: 588–99

- **Consistency and robustness of forecasting for emerging technologies: The case of Li-ion batteries for electric vehicles** *ENERGY POLICY*
  Sakti, A., Azevedo, I. L., Fuchs, E. H., Michalek, J. J., Gallagher, K. G., Whitacre, J. F.
  2017; 106: 415–26

- **Rethinking the Social Cost of Carbon Dioxide** *ISSUES IN SCIENCE AND TECHNOLOGY*
  Morgan, M., Vaishnav, P., Dowlatabadi, H., Azevedo, I. L.
  2017; 33 (4): 43–50
- **Estimating the effect of multiple environmental stressors on coral bleaching and mortality** *PLOS ONE*
  Welle, P. D., Small, M. J., Doney, S. C., Azevedo, I. L.
  2017; 12 (5): e0175018
- **Lessons from wind policy in Portugal** *ENERGY POLICY*
  Pena, I., Azevedo, I. L., Fialho Marcelino Ferreira, L.
  2017; 103: 193–202
- **Spatially resolved air-water emissions tradeoffs improve regulatory impact analyses for electricity generation** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Gingerich, D. B., Sun, X., Behrer, A., Azevedo, I. L., Mauter, M. S.
  2017; 114 (8): 1862–67
- **An integrated approach for estimating greenhouse gas emissions from 100 US metropolitan areas** *ENVIRONMENTAL RESEARCH LETTERS*
  Markolf, S. A., Matthews, H., Azevedo, I. L., Hendrickson, C.
  2017; 12 (2)
- **How much electricity can we save by using direct current circuits in homes? Understanding the potential for electricity savings and assessing feasibility of a transition towards DC powered buildings** *APPLIED ENERGY*
  Glasgo, B., Azevedo, I., Hendrickson, C.
  2016; 180: 66–75
- **Known unknowns: indirect energy effects of information and communication technology** *ENVIRONMENTAL RESEARCH LETTERS*
  Horner, N. C., Shehabi, A., Azevedo, I. L.
  2016; 11 (10)
- **Should we build wind farms close to load or invest in transmission to access better wind resources in remote areas? A case study in the MISO region** *ENERGY POLICY*
  Lamy, J. V., Jaramillo, P., Azevedo, I. L., Wiser, R.
  2016; 96: 341–50
- **Air emission implications of expanded wastewater treatment at coal-fired generators**
  Gingerich, D., Sun, X., Behrer, A., Azevedo, I., Mauter, M.
  AMER CHEMICAL SOC.2016
- **Trace element allocation across air pollution control devices in coal fired power plants**
  Sun, X., Gingerich, D., Azevedo, I., Mauter, M.
  AMER CHEMICAL SOC.2016
- **China's wind electricity and cost of carbon mitigation are more expensive than anticipated** *ENVIRONMENTAL RESEARCH LETTERS*
  Lam, L. T., Branstetter, L., Azevedo, I. L.
  2016; 11 (8)
- **Effect of regional grid mix, driving patterns and climate on the comparative carbon footprint of gasoline and plug-in electric vehicles in the United States** *ENVIRONMENTAL RESEARCH LETTERS*
  Yuksel, T., Tamayao, M. M., Hendrickson, C., Azevedo, I. L., Michalek, J. J.
  2016; 11 (4)
- **Alternative Fuel Vehicle Adoption Increases Fleet Gasoline Consumption and Greenhouse Gas Emissions under United States Corporate Average Fuel Economy Policy and Greenhouse Gas Emissions Standards** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Jenn, A., Azevedo, I. L., Michalek, J. J.
  2016; 50 (5): 2165–74
- **Forecasting light-duty vehicle demand using alternative-specific constants for endogeneity correction versus calibration** *TRANSPORTATION RESEARCH PART B-METHODOLOGICAL*
  Haaf, C., Morrow, W., Azevedo, I. L., Feit, E., Michalek, J. J.

2016; 84: 182–210

- **Dynamic Data Center Load Response to Variability in Private and Public Electricity Costs**
  Horner, N., Azevedo, I., Sicker, D., Agarwal, Y., IEEE
  IEEE.2016

- **Heterogeneity in the response to gasoline prices: Evidence from Pennsylvania and implications for the rebound effect** *ENERGY ECONOMICS*
  Gillingham, K., Jenn, A., Azevedo, I. L.
  2015; 52: S41–S52

- **A review of learning rates for electricity supply technologies** *ENERGY POLICY*
  Rubin, E. S., Azevedo, I. L., Jaramillo, P., Yeh, S.
  2015; 86: 198–218

- **Comparison of Life Cycle Greenhouse Gases from Natural Gas Pathways for Light-Duty Vehicles** *ENERGY & FUELS*
  Tong, F., Jaramillo, P., Azevedo, I. L.
  2015; 29 (9): 6008–18

- **Regional Variability and Uncertainty of Electric Vehicle Life Cycle CO2 Emissions across the United States** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Tamayao, M. M., Michalek, J. J., Hendrickson, C., Azevedo, I. L.
  2015; 49 (14): 8844–55

- **Comparison of Life Cycle Greenhouse Gases from Natural Gas Pathways for Medium and Heavy-Duty Vehicles** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Tong, F., Jaramillo, P., Azevedo, I. L.
  2015; 49 (12): 7123–33

- **How will we fund our roads? A case of decreasing revenue from electric vehicles** *TRANSPORTATION RESEARCH PART A-POLICY AND PRACTICE*
  Jenn, A., Azevedo, I., Fischbeck, P.
  2015; 74: 136–47

- **Nonproliferation improvements and challenges presented by small modular reactors** *PROGRESS IN NUCLEAR ENERGY*
  Prasad, S., Abdulla, A., Morgan, M., Azevedo, I.
  2015; 80: 102–9

- **Bulk Energy Storage Increases United States Electricity System Emissions** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Hittinger, E. S., Azevedo, I. L.
  2015; 49 (5): 3203–10

- **Assessing regional differences in lighting heat replacement effects in residential buildings across the United States** *APPLIED ENERGY*
  Min, J., Azevedo, I., Hakkarainen, P.
  2015; 141: 12–18

- **Changing the Renewable Fuel Standard to a Renewable Material Standard: Bioethylene Case Study** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Posen, I., Griffin, W., Matthews, H., Azevedo, I. L.
  2015; 49 (1): 93–102

- **Evaluating the Benefits of Commercial Building Energy Codes and Improving Federal Incentives for Code Adoption** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Gilbraith, N., Azevedo, I. L., Jaramillo, P.
  2014; 48 (24): 14121–30

- **Economic analysis of the profitability of existing wind parks in Portugal** *ENERGY ECONOMICS*
  Pena, I., Azevedo, I., Fialho Marcelino Ferreira, L.
  2014; 45: 353–63

- **Comparing the magnitude of simulated residential rebound effects from electric end-use efficiency across the US** *ENVIRONMENTAL RESEARCH LETTERS*
  Thomas, B. A., Hausfather, Z., Azevedo, I. L.
  2014; 9 (7)

- **The role of energy storage in accessing remote wind resources in the Midwest** *ENERGY POLICY*
  Lamy, J., Azevedo, I. L., Jaramillo, P.
  2014; 68: 123–31
- **Should policy-makers allocate funding to vehicle electrification or end-use energy efficiency as a strategy for climate change mitigation and energy reductions? Rethinking electric utilities efficiency programs** *ENERGY POLICY*
  Thomas, B. A., Azevedo, I. L.
  2014; 67: 28–36
- **Consumer End-Use Energy Efficiency and Rebound Effects** *ANNUAL REVIEW OF ENVIRONMENT AND RESOURCES, VOL 39*
  Azevedo, I. L., Gadgil, A., Liverman, D. M.
  2014; 39: 393–418
- **Labeling energy cost on light bulbs lowers implicit discount rates** *ECOLOGICAL ECONOMICS*
  Min, J., Azevedo, I. L., Michalek, J., de Bruin, W.
  2014; 97: 42–50
- **The impact of federal incentives on the adoption of hybrid electric vehicles in the United States** *ENERGY ECONOMICS*
  Jenn, A., Azevedo, I. L., Ferreira, P.
  2013; 40: 936–42
- **Effects of government incentives on wind innovation in the United States** *ENVIRONMENTAL RESEARCH LETTERS*
  Horner, N., Azevedo, I., Hounshell, D.
  2013; 8 (4)
- **Regional variations in the health, environmental, and climate benefits of wind and solar generation** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Siler-Evans, K., Azevedo, I., Morgan, M., Apt, J.
  2013; 110 (29): 11768–73
- **Expert assessments of the cost of light water small modular reactors** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Abdulla, A., Azevedo, I., Morgan, M.
  2013; 110 (24): 9686–91
- **Reducing US Residential Energy Use and CO2 Emissions: How Much, How Soon, and at What Cost?** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Azevedo, I., Morgan, M., Palmer, K., Lave, L. B.
  2013; 47 (6): 2502–11
- **Estimating direct and indirect rebound effects for US households with input-output analysis Part 1: Theoretical framework** *ECOLOGICAL ECONOMICS*
  Thomas, B. A., Azevedo, I. L.
  2013; 86: 199–210
- **Estimating direct and indirect rebound effects for US households with input-output analysis. Part 2: Simulation** *ECOLOGICAL ECONOMICS*
  Thomas, B. A., Azevedo, I. L.
  2013; 86: 188–98
- **Electricity consumption and energy savings potential of video game consoles in the United States** *ENERGY EFFICIENCY*
  Hittinger, E., Mullins, K. A., Azevedo, I. L.
  2012; 5 (4): 531–45
- **Edison Revisited: Should we use DC circuits for lighting in commercial buildings?** *ENERGY POLICY*
  Thomas, B. A., Azevedo, I. L., Morgan, G.
  2012; 45: 399–411
- **Marginal Emissions Factors for the U.S. Electricity System** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Siler-Evans, K., Azevedo, I., Morgan, M.
  2012; 46 (9): 4742–48
- **Distributed cogeneration for commercial buildings: Can we make the economics work?** *ENERGY POLICY*

Siler-Evans, K., Morgan, M., Azevedo, I.
2012; 42: 580–90

- **ICT solutions in transportation systems: estimating the benefits and environmental impacts in the Lisbon**
Baptista, P. C., Azevedo, I. L., Farias, T. L., Aguilera, Bhouri, N., Farhi, N., Leurent, F., Seidowsky, R.
ELSEVIER SCIENCE BV.2012: 716–25

- **Designing building energy efficiency programs for greenhouse gas reductions** *ENERGY POLICY*
Blackhurst, M., Azevedo, I., Matthews, H., Hendrickson, C. T.
2011; 39 (9): 5269–79

- **Preparing US community greenhouse gas inventories for climate action plans** *ENVIRONMENTAL RESEARCH LETTERS*
Blackhurst, M., Matthews, H., Sharrard, A. L., Hendrickson, C. T., Azevedo, I.
2011; 6 (3)

- **Residential electricity consumption in Portugal: Findings from top-down and bottom-up models** *ENERGY POLICY*
Wiesmann, D., Azevedo, I., Ferrao, P., Fernandez, J. E.
2011; 39 (5): 2772–79

- **The Transition to Solid-State Lighting** *PROCEEDINGS OF THE IEEE*
Azevedo, I., Morgan, M., Morgan, F.
2009; 97 (3): 481–510

PRESENTATIONS

- Effects of On-Demand Ridesourcing on U.S. Vehicle Ownership, Travel Patterns, and Energy Use Externalities - NBER Conference on Economics of Energy Use in Transportation (5/3/2019)