

Current Methods for Life Cycle Analyses of Low-Carbon Transportation Fuels in the United States

Committee

Valerie M. Thomas

Chair

Valerie M. Thomas (Chair) is the Anderson-Interface Professor of Natural Systems in the H. Milton Stewart School of Industrial and Systems Engineering, at the Georgia Institute of Technology, College of Engineering. She holds a secondary appointment as Professor in the School of Public Policy. She received a BA in physics from Swarthmore College in 1981, a PhD in high-energy physics from Cornell University in 1987, and completed post-doctoral training at Carnegie Mellon University in the Department of Engineering and Public Policy. Before coming to Georgia Tech she worked at Princeton University in the Center for Energy and Environmental Studies and at the Princeton Environmental Institute. She has also served as the American Physical Society Congressional Science Fellow. Her research is in the area of environmental lifecycle analysis, energy systems analysis, industrial ecology, and sustainability. Recent work has included evaluation of the environmental impacts of biofuels, direct air capture of carbon dioxide, and production of platform chemicals from biomass; comparison of electric vehicle technologies; smart-grid approaches to reducing health impacts from power plants; infrastructure resilience; and international electricity development pathways. She has also worked on leaded gasoline, dioxin, and nuclear issues. In the last several years she has had funding from the United States Department of Energy, Algenol Biotech, the Natural Resources Defense Council, Exxon Mobil Corporate Strategic Research, the National Science Foundation, Green Seal, and the JPB Foundation. She is a fellow of the American Physical Society and of the American Association for the Advancement of Science. She has previously served on the US EPA Science Advisory Board and on the US Department of Agriculture and Department of Energy's Biomass Research and Development Technical Advisory Committee.

Amos A. Avidan

Member

Amos A. Avidan has retired as SVP and manager of Corporate Engineering & Technology from Bechtel Corporation. His primary interest has been in energy systems, including transportation fuels, from conventional hydrocarbons fuels, synthetic fuels, biofuels, reformulated fuels and various proposed alternative fuels. He started his career working on developing synthetic fuels, then moved on to the production of conventional and reformulated fuels, and then on to natural gas based fuels, especially liquefied natural gas (LNG). Amos holds a PhD in Chemical Engineering from the City University of New York. He has authored and co-authored numerous technical publications and patents, and has been elected to the National Academy of Engineering in 2009.

Jennifer Dunn

Member

Jennifer B. Dunn studies emerging technologies, their energy and environmental impacts, and their potential to influence greenhouse gas and air pollutant emissions, water consumption, and energy consumption at the economy-wide level. Particular technologies of interest include biofuels and bioproducts, automotive lithium-ion batteries, waste plastics recycling and utilization, advanced manufacturing, and fuels and chemicals made from natural gas liquids. Techno-economic and life cycle analyses are primary tools in her research. Land use change, which drives the sustainability debate surrounding biofuels, has been an important aspect of her work for a decade. She has collaborated with economists and soil carbon modeling experts to incorporate the results of computable general equilibrium models coupled with soil carbon modeling into life cycle analyses of biofuels. Results of these collaborations are documented in several publications. Furthermore, she applies machine learning techniques to gain insights into land use and land use change, which drive the sustainability debate surrounding biofuels. She has published extensively on the life cycle assessment of low-carbon transportation fuels and has served on a National Academies Committee on Developing a Research Agenda for Utilization of Gaseous Carbon Waste Streams (2017-2018). Jennifer enjoys leadership roles in sustainability research and practice at Northwestern as the Associate Director of the Center for Engineering Sustainability and Resilience and the Co-Chair of the Sustainability Council. Jennifer holds a Ph.D. and M.S. in Chemical Engineering from the University of Michigan and a B.S. in Chemical Engineering from Purdue University.

Patrick L. Gurian

Member

Patrick L. Gurian is a Professor in the Department of Civil, Architectural, and Environmental Engineering at Drexel University. He has an A.B. from Harvard in chemistry, an M.S. in environmental engineering from Stanford University, and a Ph.D. in engineering & public policy and civil & environmental engineering from Carnegie Mellon University. He has over 20 years of experience in policy analysis of technological systems with particular attention to supporting regulatory decision making under uncertainty. He has studied how to address the uncertainty in the lifecycle impacts of biofuels, given the variety of conditions under which the feedstocks for these fuels are cultivated.

Jason D. Hill

Member

Jason D. Hill is Professor in the Department of Bioproducts and Biosystems Engineering at the University of Minnesota. He also serves as a Resident Fellow of the University's Institute on the Environment. His research focuses on the environmental consequences of food, energy, agriculture, and natural resource use from a life-cycle perspective. He served on the National Research Council's Committee on the Economic and Environmental Impacts of Increasing Biofuels Production and on the US EPA Science Advisory Board Biogenic Carbon Advisory Panel. Dr. Hill received his AB in Biology from Harvard College and his PhD in Plant Biological Sciences from the University of Minnesota.

Madhu Khanna

Member

Madhu Khanna is the ACES Distinguished Professor of Environmental Economics and Interim Director of the Institute for Sustainability, Energy, and Environment at the University of Illinois at Urbana-Champaign. She internationally renowned for developing economic models to analyze the direct life-cycle GHG savings, indirect land use change effects, and biogenic carbon emission effects of first- and second-generation biofuels and of bioelectricity. She has deep expertise in data needs, modeling assumptions, integrating economic and ecosystem models and uncertainty analysis to study the implications of various methods for life-cycle analysis on the estimates of GHG savings and land use change due to low carbon fuels under a range of climate and renewable energy policies, including the Low Carbon Fuel Standard, the Renewable Fuels Standard, carbon taxes, and others. Dr. Khanna has served on the Chartered Science Advisory Board of the USEPA and twice as a chair for their panel assessing the EPA's Accounting Framework for Biogenic CO₂ Emissions from Stationary Sources. She is a Fellow and the President-Elect of the Agricultural and Applied Economics Association. She obtained her Ph.D. in agricultural and resource economics from the University of California at Berkeley in 1995.

Annie Levasseur

Member

Annie Levasseur is a Professor at the Department of Construction Engineering of Ecole de technologie supérieure, an engineering faculty based in Montreal, Canada. She is also the Chairholder of the Canada Research Chair in Measuring the Impact of Human Activities on Climate Change and the Scientific Director of the Centre of Intersectoral Studies and Research on Circular Economy. She is a Chemical Engineer by training (1999, Polytechnique Montreal) and worked in the oil refining industry for 8 years. She then got a PhD degree (2011, Polytechnique Montreal) with a thesis about the development of a dynamic life cycle assessment approach for global warming impact assessment. She teaches the integration of environmental and sustainability aspects in engineering projects. Her research expertise is about environmental impact assessment using different methods or combinations of approaches such as life cycle assessment, greenhouse gas emission inventories, and so on. She works on projects in different sectors, especially in forestry, energy, and construction. She is a recognized expert on topics related to biofuels LCA such as the consideration of biogenic carbon fluxes and of the timing of GHG emissions. She often acts as an expert in the field of life cycle assessment of bioenergy. For instance, she was the Chair of the critical review panel for the Fuel LCA Model Methodology developed by Environment and Climate Change Canada for the coming Canadian Clean Fuel Standard. A few years ago, she was part of the NAS project 'Negative Emissions Technologies and Reliable Sequestration: a Research Agenda'.

Jeremy I. Martin

Member

Jeremy I. Martin is Director of Fuels Policy and a Senior Scientist in the Clean Vehicles Program at the Union of Concerned Scientists (UCS). Dr. Martin works on state and federal fuels policies and has testified before Congress and state legislatures and briefed legislators and regulators on key fuel policies.

Dr. Martin is the author of more than 15 technical publications and 13 patents on topics including biofuels, autonomous vehicles, semiconductors and polymer physics. His recent reports for UCS cover transportation fuels and fuel policy, ride-hailing and automated vehicles.

Before coming to UCS, Dr. Martin worked in research and development and manufacturing of computer chips at Advanced Micro Devices. Dr. Martin has a Ph.D. in chemistry and a minor in chemical engineering from the California Institute of Technology and a bachelor's degree in chemistry and English literature from Haverford College.

Jeremy J. Michalek

Member

Jeremy J. Michalek is a Professor of Engineering & Public Policy, Professor of Mechanical Engineering, and Director of the Vehicle Electrification Group at Carnegie Mellon University. His research focuses on technical, economic, environmental and policy aspects of vehicle electrification, automation, sharing, and other trends in advanced vehicle technologies. Michalek's awards include the ASME Thar Energy Design Award, the Fenves Award for Systems Research, and the National Science Foundation CAREER Award. He serves on the Alternative Transportation Fuels and Technologies Committee of the Transportation Research Board of the National Academies.

Steffen Mueller

Member

Steffen Mueller leads the Bioenergy and Sustainable Landscapes Research Group at the University of Illinois at Chicago. Research activities focus on life cycle emissions analyses of fuel pathways including greenhouse gas emissions assessments from land use change related to biofuels and bioenergy production, quantification of carbon emissions and sequestration effects from production agriculture, and comparative emissions assessments between biofuel and electric vehicle use. Recently, Steffen has been serving as a technical expert to the US Grains Council on the sustainability of US produced biofuels for export markets and presented his research in Japan, Korea, China, India, Vietnam, Columbia, and Mexico. He served on the Expert Working Group on Land Use Change for the California Low Carbon Fuel Standard development in 2010 and has published widely on the use of remote sensing technologies for land cover and land use change assessments. Steffen is also a Board Member of International Sustainability and Carbon Certification (ISCC). Dr. Mueller has published over 20 peer reviewed papers on life cycle analysis with a wide network of collaborators including Argonne National Laboratory and the U.S. Department of Agriculture. Prior to joining the University of Illinois in 2001 he worked in the private sector as Director of Business Development for Skygen Energy and Calpine Corporation, a developer of electric generation power plants. Steffen holds a PhD in Energy Policy from the University of Illinois at Chicago, an MBA and a B.S. in Environmental Engineering from Karlsruhe, Germany.

Nikita Pavlenko

Member

Nikita Pavlenko is a senior researcher with the ICCT's Fuels team. He evaluates the climate implications and techno-economics of advanced alternative fuels, with a focus on the aviation sector. He has been nominated as a participant at the International Civil Aviation Organization's Fuels Task Workgroup to develop the implementation of alternative fuels crediting under CORSIA, and has presented his research on life-cycle assessment at Coordinating Research Council workshop at Argonne National Laboratory. Mr. Pavlenko has a background in carbon accounting and comparative life-cycle analysis, particularly as applied to fuel production. Prior to joining the ICCT, Mr. Pavlenko supported the EPA's life-cycle material management model, the Waste-Reduction Model (WARM), as well as contributed life-cycle assessment expertise to a variety of environmental impact statements on fossil fuel infrastructure and vehicle efficiency.

Donald W. Scott

Member

Donald W. Scott has 14 years of experience in lifecycle analysis of transportation fuels. He has contributed to the U.S. Life Cycle Inventory Database and numerous publications quantifying the direct and consequential lifecycle impacts of biofuels including land management and land use change. As the Director of Sustainability for the National Biodiesel Board (Aug. 2008-Aug 2020), Scott led consensus on the development of sustainability principles adopted by the U.S. industry. Scott also chairs the subcommittee on biomass sustainability under ASTM International. Scott currently audits producers and purveyors of biofuels and circular materials under the International Sustainability and Carbon Certification framework. Scott is a licensed professional engineer with a degree in civil engineering from the University of Missouri-Columbia, where he graduated in 1995. Scott also served as Chief of Surface Water for the Missouri Water Resources Center and served 12 years enhancing watershed protection for the Missouri Department of Natural Resources.

Corinne D. Scown

Member

Corinne D. Scown is a Staff Scientist and Deputy Division Director in the Energy Analysis & Environmental Impacts Division at Lawrence Berkeley National Laboratory. She serves as Vice President for the Life-cycle, Economics, and Environmental Impacts Division (LEAD) at the Joint BioEnergy Institute (JBEI) and also serves as Head of Sustainability at the Energy & Biosciences Institute at the University of California, Berkeley. Dr. Scown received a BS in Civil & Environmental Engineering with a double major in Engineering and Public Policy in 2006 from Carnegie Mellon University. She received her MS in 2008 and PhD in 2010, both in Civil & Environmental Engineering at UC Berkeley. She was awarded an NSF Graduate Research Fellowship in 2007. Dr. Scown is an expert in life-cycle assessment and technoeconomic analysis, with a focus on bio-based transportation fuel, waste-to-energy systems, and bioproducts. Along with a team at JBEI, she received the Secretary of Energy's Achievement Award in 2018. She has published more than 40 publications in journals including PNAS, Energy & Environmental Science, Science Advances, and Nature. She also serves on the editorial boards at ACS Sustainable Chemistry & Engineering, Agronomy Journal, and Environmental Research: Infrastructure and Sustainability.

Dev S. Shrestha

Member

Dev S. Shrestha is a Professor at University of Idaho, Department of Chemical and Biological Engineering. The University of Idaho has a long history of Biofuel research since 1979. Dr. Shrestha joined University of Idaho in 2004 after receiving his Ph.D. in Agricultural Engineering from Iowa State University. One of his research areas includes life cycle analysis of agricultural system primarily biofuel. Dr. Shrestha has published several research papers related to the topic area including indirect land use change and Food Vs. Fuel issues. Currently Dr. Shrestha maintains National website for biodiesel education called BiodieselEducation.org, which he and his colleagues developed during last 15 years as a part of USDA's National Biodiesel Education program. He teaches course at the university related to energy and environmental policies.

Farzad Taheripour

Member

Taheripour is a research professor in energy economics in the Department of Agricultural Economics of Purdue University. He received his Ph.D. in agricultural economics from the University of Illinois at Urbana-Champaign in 2006. Professor Taheripour's research interests are in the areas of energy, agriculture, policy analysis, economic modeling, and life cycle assessment (LCA). He is the leading scholar in assessing biofuels induced land use change (ILUC) emissions. He collaborates with several national and international organizations and institutions. Currently, Dr. Taheripour is a US delegate in the Alternative Fuels Task Force (AFTF) group of the Committee on Aviation Environmental Protection of the International Civil Aviation Organization (ICAO). As a delegate in the AFTA, Dr. Taheripour leads the efforts to assess ILUC values for aviation biofuels, a major component of the LCA for aviation biofuels. He is the GTAP Research Fellow for the term of 2017-2020. He has over 110 professional publications including journal papers, book chapters, conference papers, and reports with more than 2800 citations. His i10 publication index is 53, meaning that he has 53 books, book chapters, or papers with at least 10 citations each. His h index is 29, meaning he has 29 publications with 29 or more citations.

Yuan Yao

Member

Yuan Yao is an Assistant Professor of Industrial Ecology and Sustainable Systems at the Yale School of the Environment. Before joining Yale, she was an Assistant Professor of Sustainability Science and Engineering at North Carolina State University. She has expertise in Life Cycle Assessment (LCA), Techno-Economic Analysis, carbon footprint accounting, data analytics, and systems modeling. Her current research focuses on carbon emissions and LCA modeling of biofuels and biomass-based products. She received the National Science Foundation Faculty Early Career Development Award (CAREER). She has been named to the American Institute of Chemical Engineers "35 Under 35" list for emerging chemical engineering leaders. Yao serves as the Associate Editor for the journal Resources, Conservation & Recycling. Yao published papers in leading journals such as Nature Sustainability and Environmental Science and Technology. She also served on the Technical Advisory Group for LEAP Partnership in the Food and Agriculture Organization of the United Nations. She received her Ph.D. degree in Chemical Engineering from Northwestern University.