Atmospheric Methane Removal: Development of a Research Agenda

Committee

Gabrielle B. Dreyfus

Chair

Gabrielle Dreyfus (Chair) is chief scientist at the Institute for Governance & Sustainable Development (IGSD) and an adjunct lecturer at Georgetown University. She has over a decade of experience working at the science and policy interface including through positions with the U.S. Department of Energy, National Oceanic and Atmospheric Administration, and U.S. Senate. In addition to dozens of scientific and technical publications, Dreyfus worked as the lead coordinating author on a synthesis report by the International Energy Agency and United Nations Environment Programme on the intersection of energy efficiency and the phasedown of fluorinated gases in the cooling sector. She is a member of the Climate and Clean Air Coalition's Scientific Advisory Panel and the Montreal Protocol's Technology and Economic Assessment Panel. She was a 2021 Honoree of Environment+Energy Leader 100. Dreyfus received a B.A. in Earth and planetary sciences from Harvard University, and an M.S. and Ph.D. in geosciences from Princeton University and Sorbonne Université. In 2022 she served on the National Academies of Sciences, Engineering, and Medicine's Committee on Development of a Framework for Evaluating Global Greenhouse Gas Emissions Information for Decision Making.

Dreyfus has provided uncompensated feedback to philanthropic organizations, including Spark Climate Solutions, that are engaged in activities related to methane removal research. IGSD has received funding from Spark Climate Solutions for research related to methane mitigation and the president of IGSD has made public statements related to curbing methane emissions. Dreyfus has co-authored several opinion pieces on reducing methane emissions.

Holly J. Buck

Member

Holly Buck is an Associate Professor of Environment and Sustainability at the University at Buffalo. Previously, Buck was a NatureNet Science Fellow at the University of California, Los Angeles Institute of the Environment and Sustainability, and an Emmett Climate Engineering Fellow at the UCLA School of Law, with research focusing on the governance of climate engineering. She is an interdisciplinary social scientist who works across rural sociology, human geography, and science and technology studies to understand the social and environmental dimensions of emerging technologies. Her recent and current research involves understanding the social dimensions of technologies to remove carbon from the atmosphere. She is a contributing author to the Intergovernmental Panel on Climate Change's Sixth Assessment Report Working Group III chapter regarding carbon dioxide removal and cross-sectoral governance. Buck received a B.A. in English from the University of Maryland, Baltimore, an M.Sc. in human ecology from Lund University, and a Ph.D. in development sociology from Cornell University with a focus on public engagement with emerging environmental technologies. She previously served on the National Academies' Committee on a Research Strategy for Ocean Carbon Dioxide Removal and Sequestration.

Buck has made public statements about the need for responsible, publicly funded research into the risks and benefits of carbon removal and solar geoengineering as well as published a book advocating for the phaseout of fossil fuels.

Hinsby Cadillo-Quiroz

Member

Hinsby Cadillo-Quiroz is an Associate Professor at Arizona State University with a dual appointment in the School of Life Sciences and Biodesign Institute and leads the Ecology of Microorganisms and Ecosystems laboratory. His expertise spans the microbial physiology of methanogens and methanotrophs, ecosystem studies of methane emissions, as well as collaborations on landscape-level assessments of atmospheric methane. Cadillo-Quiroz's current research focuses on methane production, consumption, and possible management questions including microbial interaction tests with pure cultures, small to medium scale bioreactors, as well as environmental studies of landfills, northern forest, and tropical peatlands in the Amazon Basin. He has been recognized with a Fulbright Scholarship, a Presidential Scholarship at Cornell University, a National Science Foundation CAREER Award, and an Honorific Doctorate in Forestry by the National University of the Peruvian Amazon. Cadillo-Quiroz received a B.S. in biology and microbiology from Universidad Nacional Mayor de San Marcos, Peru and a Ph.D. in microbiology with a minor in ecology from Cornell University.

Benjamin A. Converse

Member

Benjamin A. Converse is an Associate Professor of Public Policy and Psychology at the University of Virginia. He is a social psychologist with appointments in the Frank Batten School of Leadership and Public Policy and the Department of Psychology. As Director of the Social Behavior and Decisions Lab, Converse collaborates with graduate and undergraduate students, postdocs, and research associates at the University of Virginia and beyond to conduct behavioral science research in the lab and field. The team explores social, behavioral, and cognitive processes that contribute to human goal pursuit and decision making in a social and resource-constrained world. Converse received a B.A. in psychological and brain sciences from Dartmouth College and a Ph.D. in managerial and organizational behavior from the University of Chicago Booth School of Business.

M. M. Faruque Hasan

Member

Faruque Hasan is an Associate Professor and the Kim and Phillip McDivitt Faculty Fellow in the Artie McFerrin Department of Chemical Engineering at Texas A&M University. He also serves as an Assistant Director of Decarbonization at the Texas A&M Energy Institute. His research group develops multiscale methods, tools, and techniques for process systems engineering, design, analysis, and optimization with direct applications to decarbonization of the energy and industrial sectors. Specific technological interests include carbon capture, utilization and storage, methane separation, sustainable hydrogen economy, and resilient supply chains. Hasan is the recipient of a National Science Foundation CAREER award, American Chemical Society Petroleum Research Fund New Doctoral Investigator award, and Outstanding Young Researcher award from the Computing & Systems Technology Division of the American Institute of Chemical Engineers. Hasan received a Ph.D. in chemical engineering from National University of Singapore and completed his postdoctoral training at Princeton University.

Hasan is the scientific co-founder of CryoL, LLC, which focuses on technology for removal of carbon dioxide from industrial flue gas.

Robert B. Jackson

Member

Robert Jackson is the Douglas Provostial Professor of Energy and Environment at Stanford University. He chairs the Global Carbon Project, which tracks emissions of greenhouse gases such as carbon dioxide, methane, and nitrous oxide. His lab measures methane emissions from anthropogenic systems, including oil fields, city streets, and homes and buildings, and natural systems, recently establishing the new FLUXNET-CH4 database of nearly 100 methane flux towers globally and a new network of tropical wetland emissions. He is a member of the American Academy of Arts and Sciences, a Guggenheim Fellow, and a Fellow in the American Association for the Advancement of Science, American Geophysical Union, and the Ecological Society of America. Jackson received a B.S. in chemical engineering from Rice University and an M.S. in statistics and Ph.D. in ecology from Utah State University.

Jackson currently serves in an uncompensated advisory role for Spark Climate Solutions and previously received compensation for consulting services for Spark. Jackson serves on the board of Methane Action. He co-founded Torch, a methane mitigation startup in 2020, and the entity is no longer active. Jackson has made public statements in the media on methane emissions and methane removal, and in July 2024 published the book, Into the Clear Blue Sky.

Sikina Jinnah

Member

Sikina Jinnah is a Professor of Environmental Studies and affiliated graduate faculty of Politics at the University of California, Santa Cruz. She edits the journal Environmental Politics and co-chairs Harvard University’s Advisory Committee for the Stratospheric Controlled Perturbation Experiment (SCoPEx). Her research focuses on global environmental governance, in particular, the areas of climate change, climate engineering, and the nexus between international trade and environmental politics. Most recently she has been working to develop theoretically-derived recommendations for the governance of solar geoengineering technologies. She is the author or editor of 6 books, including “Post-treaty Politics” (MIT Press 2014), which received the 2016 Harold and Margaret Sprout Award for best book in international environmental affairs from the International Studies Association and “Greening through Trade” (MIT Press 2020), which was a finalist for the 2021 Canadian Political Science Association Prize in International Relations. She is a 2017 Andrew Carnegie Fellow. Jinnah received a B.A. in environmental science from the University of California, Berkeley, an M.S. in environmental studies from the University of Montana, Missoula, and a Ph.D. in environmental science, policy, and management from the University of California, Berkeley.

Christopher W. Jones

Member

Christopher W. Jones (NAE) is the John F. Brock III School Chair and Professor of Chemical and Biomolecular Engineering at the Georgia Institute of Technology. His research activities focus on catalysis and adsorptive gas separations and he has extensively studied the removal of carbon dioxide from the atmosphere. Jones is currently the Vice President of the North American Catalysis Society and the International Adsorption Society. He was the founding Editor-in-Chief (EIC) of the American Chemical Society (ACS) journal ACS Catalysis and is currently the EIC of the journal JACS Au. He is a Fellow of ACS, the American Association for the Advancement of Science, and was elected to the National Academy of Engineering in 2022. Jones received a B.S.E. in chemical engineering from the University of Michigan and an M.S. and Ph.D. in chemical engineering from the California Institute of Technology. He previously served on the National Academies of Sciences, Engineering, and Medicine's Committee on Developing a Research Agenda for Carbon Dioxide Removal and Reliable Sequestration.

Jones has a financial interest in Global Thermostat, a technology start-up that seeks to remove carbon dioxide from the air.

April B. Leytem

Member

April Leytem is a research scientist with the United States Department of Agriculture (USDA) – Agricultural Research Service at the Northwest Irrigation and Soils Research Laboratory in Kimberly, Idaho. Her research focuses on improving the sustainability of integrated cropping and livestock production systems. Leytem has over 17 years' experience monitoring greenhouse gas emissions from livestock production and cropping systems. In addition, she works collaboratively to improve whole farm modelling efforts aimed at estimating the carbon footprint of dairy production as well as improving national inventories. She has participated as a contributing author to the IPCC 2019 refinement of "Chapter 10 - Emissions from Livestock and Manure Management" and is the lead author of the 2023 refinement of "Chapter 4 – Quantifying greenhouse gas sources and sinks in animal production systems" in the USDA "Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry." Leytem received a B.A. in economics from Brandeis University and an M.A. in international development (natural resources) and Ph.D. in soil science with an organic chemistry minor from North Carolina State University. She previously served on the National Academies of Sciences, Engineering, and Medicine's Committee on Anthropogenic Methane Emissions in the United States: Improving Measurement, Monitoring, Reporting, and Development of Inventories.

Thomas E. McKone

Member

Thomas McKone is Professor Emeritus in the School of Public Health at the University of California, Berkeley and a Retired Affiliate at Lawrence Berkeley National Laboratory (LBNL). His research career focused on the development, use, and evaluation of models and data for environmental risk assessments and the health and environmental impacts of energy, industrial, and agricultural systems. He served on the U.S. Environmental Protection Agency Science Advisory Board, worked with several World Health Organization committees, and has been on consultant committees for the Organization for Economic Cooperation and Development, the World Health Organization, the International Atomic Energy Agency, and the Food and Agriculture Organization. McKone is a fellow of the Society for Risk Analysis, former president of the International Society of Exposure Science from which he received the Constance L. Mehlman Award and the Jerome J. Wesolowski award for outstanding contributions to exposure science, and was the 2019 Recipient of the LBNL Lifetime Achievement Award. McKone received a B.A. in chemistry from St. Thomas College and an M.S. and Ph.D. in engineering from the University of California, Los Angeles. He has been a member of more than a dozen committees of the National Academies of Sciences, Engineering, and Medicine and most recently served on its Board on Environmental Studies and Toxicology.

Simon H. Pang

Member

Simon Pang is an Associate Group Leader at Lawrence Livermore National Laboratory (LLNL) and leads the Direct Air Capture program within LLNL’s Carbon Initiative. He is interested in development and implementation of materials and technologies for carbon dioxide removal, the interface between carbon capture and carbon conversion technologies to develop a circular carbon economy, and systems analysis for carbon removal and energy technologies. Pang’s research spans topics from fundamental investigations of direct air capture materials degradation mechanisms to development of hybrid reactive capture processes that integrate carbon capture and conversion. He has participated as a contributing author to LLNL’s report “Getting to Neutral,” for which the team received a Department of Energy Secretary of Energy Achievement Award. Pang received a B.S. in chemical engineering from Cornell University and a Ph.D. in chemical engineering from the University of Colorado Boulder.

José G. Santiesteban

Member

José G. Santiesteban (NAE) is retired from ExxonMobil, where he served for more than 30 years in a number of technical leadership and management roles, including, most recently, strategy manager for ExxonMobil Research and Engineering Company. In this role, he led a team that developed strategic technology direction, provided research guidance, and ensured the robustness of the research and development portfolio. His scientific and engineering expertise in heterogeneous catalysis includes design, synthesis, physical-chemical characterization of novel catalytic materials, and reaction mechanisms and kinetics. He has led and made significant technical contributions to the discovery, development, and commercialization of more than 20 novel catalyst technologies for the production of high-performing lubricants, clean fuels, and petrochemicals. Santiesteban is a member of The Academy of Medicine, Engineering, and Science of Texas, the National Academy of Engineering (NAE), and is a Council Member and on the Board of Trustees of NAE. He received the Society of Hispanic Professional Engineers 2018 Innovator Award and multiple technical and leadership awards within ExxonMobil Research and Engineering Company and Mobil Research and Development Company. Santiesteban received a B.S. in chemical engineering from Instituto Tecnológico de Chihuahua, México, an M.S. in chemical engineering from Instituto Tecnológico de Ciudad Madero, México, and a Ph.D. in physical chemistry from Lehigh University. He previously served as a member of the National Academies of Sciences, Engineering, and Medicine’s Committee on Chemical Engineering: Challenges and Opportunities in the 21st Century and currently serves on the Board on Energy and Environmental Systems.

ExxonMobil Research and Engineering, where Santiesteban was the Strategy Manager from 2016-2021, has many activities related to the mitigation of methane emissions.

Lisa Y. Stein

Member

Lisa Stein is a Professor and the Associate Chair of Research in the Department of Biological Sciences at the University of Alberta where she leads the Climate Change Microbiology laboratory. She was a postdoctoral scholar at the California Institute of Technology and National Aeronautics and Space Administration Jet Propulsion Laboratory in the Astrobiology and Life Detection groups and was previously an Assistant Professor at the University of California, Riverside. Stein's expertise is on the ecophysiology and genomics of microorganisms that produce and consume methane and nitrous oxide. Projects include constructing genome-scale metabolic models for ammonia- and methane-oxidizing bacteria that can pinpoint global gene expression as their environment becomes conducive to greenhouse gas emissions, or they can predict how oxidation products of methane are gated into value-added products like bioplastics and biofuels for methane remediation. She received the Killam Award for Excellence in Mentoring in 2022 and the Great Supervisor Award in 2018. She was elected as a Fellow in the American Academy of Microbiology in 2023. Stein received a B.A. in molecular, cellular, and developmental biology from the University of Colorado Boulder and a Ph.D. in molecular and cellular biology from Oregon State University.

Stein previously served as an uncompensated advisor for Mango Materials, Inc. and currently serves as an uncompensated advisor to Cvictus, Inc., Bioconversion Databank Foundation, and Floating Island International.

Alexander J. Turner

Member

Alex Turner is an Assistant Professor at the University of Washington in the Department of Atmospheric Sciences and the Calvin Professor of Atmospheric Science. He is an atmospheric scientist whose research combines satellite remote sensing, numerical modeling, and Bayesian inference to study interactions between the carbon cycle and atmospheric chemistry. Much of Turner’s work investigates the processes controlling the abundance and variations of greenhouse gases such as methane in the atmosphere. He is the recipient of the 2020 James R. Holton Junior Scientist Award from the American Geophysical Union. Turner received a B.S. in mechanical engineering from the University of Colorado Boulder, a Ph.D. in atmospheric chemistry from Harvard University, and was a Miller Postdoctoral Fellow at the University of California, Berkeley.

Turner is currently a compensated technical consultant on the use of satellite remote sensing for methane emission estimation for Geofinancial Analytics. Turner has previously provided expert commentary for news pieces on methane removal.

Katey M. Walter Anthony

Member

Katey Walter Anthony is an Aquatic Ecologist and Professor at the University of Alaska Fairbanks. Her research focuses on methane emissions from Arctic lakes, the degradation of permafrost, and its feedbacks to global climate processes through the carbon cycle. She has over 25 years' experience conducting field work in Alaska and Russia, is a science team member of the National Aeronautics and Space Administration Arctic-Boreal Vulnerability Experiment, and a member of the Permafrost Carbon Network. She received the National Wildlife Federation Award in 2009, National Geographic Society Early Explorer's Award in 2009, Mount Holyoke College Mary Lyon Award in 2010, WINGS WorldQuest Award in 2011, and the University of Alaska Usibelli Distinguished Research Award in 2019. Anthony received a B.A. in geology from Mount Holyoke College, an M.S. in restoration ecology from the University of California, Davis, and a Ph.D. in aquatic biology from the University of Alaska Fairbanks. She previously served on the National Academies of Sciences, Engineering, and Medicine's Polar Research Board.

Anthony has provided uncompensated advice to E44 Management Company Ltd about projects in the Arctic.

Margaret Wooldridge

Member

Margaret Wooldridge is the Walter J. Weber, Jr. Professor of Sustainable Energy, Environmental and Earth Systems Engineering, an Arthur F. Thurnau Professor in the Departments of Mechanical Engineering and Aerospace Engineering and the Director of the Institute for Energy Solutions at the University of Michigan. Wooldridge was on the faculty at Texas A&M University before joining the University of Michigan in 1998. Her research program spans diverse areas where high-temperature chemically reacting systems are critical, including power and propulsion systems, fuel chemistry, and synthesis methods for advanced nanostructured materials. Her research team has pioneered methods for characterizing fundamental fuel properties and performance in modern spark-ignition and gas turbine engines. She is a 2013 recipient of the Department of Energy Ernest Orlando Lawrence Award and a fellow of the Combustion Institute, American Society of Mechanical Engineers, Society of Automotive Engineers, and a Senior Fellow in the Michigan Society of Fellows. Wooldridge received a B.S. in mechanical engineering from the University of Illinois Urbana-Champaign and an M.S. and Ph.D. in mechanical engineering from Stanford University. She previously served as the Chair of the National Academies of Sciences, Engineering, and Medicine Committee on the Peer Review of Interim Report on Computational Fluid Dynamics Model for Predicting Wellhead Oil-Burning Efficiency at Bench and Intermediate Scales.

Rachel Silvern

Staff Officer