VIRTUAL

FOOD-ENERGY-WATER NEXUS

FEBRUARY 10-12, 2021

Organized by the Institute for Sustainability

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WELCOME ADDRESS

GREETINGS

We want to welcome you to the 2nd Food Energy-Water Nexus Conference brought to you by the Institute for Sustainability, an American Institute for Chemical Engineers Technological Community.

The FEW Nexus conference brings the greatest minds spanning multiple disciplines related to Sustainability and climate change to network and share ideas for the improvement of Sustainability in urban environments. It's an exciting time for environmental scientists and engineers as we continue to grow and adapt, always remaining motivated, responsive, and forward-looking. In this conference, we are trying to address the critical concerns of how we provide and maintain the food, energy, and water supplies in urban environments as the population continues to increase. Our conference topics provide deeper understandings into the critical areas of this problem, which include, but are not limited to Energy Focus of the FEW Equation, FEW in Arid Regions, FEW Societal Nexus, Food Waste, Sustainability, and Life Cycle Assessment, Technological Solutions for Efficient FEW Management, Urban and Controlled-Environment Agriculture.

This virtual experience developed by our programming team — including meeting chairs, session organizers, presenters, and exhibitors — will ensure that the new format provides you with the valuable experience you expect. As you know, the Water Conference is the premier forum for engineers interested in innovation and advancements in Water Treatment, as experts cover a wide range of topics relevant to cutting-edge research, new technologies, and emerging growth areas. We are excited to bring AIChE's Water Conference to a larger global audience as a virtual event.

The Food Energy Water Program will continue to provide virtual meeting attendees with compelling technical sessions, inspiring lectures, and valuable opportunities to network with speakers, exhibitors, and chemical engineering colleagues. A single stream conference consisting of technical sessions and networking events will enable attendees to interact with presenters during Q&As, participate in group discussions, attend panel discussions and engage with colleagues in the community. Much work has gone into making this conference a success. Suppose it were not for our Organizing Committee's contributions, who was instrumental in selecting our speakers and shaping the program, as well as the invaluable assistance from our Industry and Academic supporters.

Before we close, we would like to thank each of you for attending our conference and bringing your expertise to our gathering. You have the vision, knowledge, and experience to help us pave our way into the future. You are indeed our most significant asset today and tomorrow, and we could not accomplish what we do without your support and leadership. Throughout this conference, we ask you to stay engaged, keep us proactive, and help us shape the world's future through sustainability and climate change initiatives. We hope your experience is a pleasant, educational, and inspiring one.

Thank you!

CONFERENCE ORGANIZERS

Conference Chairs

Arpad Horvath, *University of California, Berkeley*
Arpad Horvath is the L. E. Peirano Professor of Civil and Environmental Engineering at the University of California, Berkeley (http://faculty.ce.berkeley.edu/horvath/), Head of the Energy, Civil Infrastructure and Climate Graduate Program, Director of the Transportation Sustainability Research Center, and Director of the Engineering and Business for Sustainability Certificate Program.

He is the Editor-in-Chief of Environmental Research: Infrastructure and Sustainability.

He is the Chair of the 2nd Food-Energy-Water Nexus Conference.

His research focuses on life-cycle environmental and economic assessment of products, processes, and services, particularly answering important questions posed about civil infrastructure systems and the built environment. He has conducted studies on the environmental implications of various products, processes and services, in particular, transportation systems, water and wastewater systems, buildings, concrete and other construction materials, pavements, and biofuels.

Professor Horvath was a member of the U.S. Environmental Protection Agency's Science Advisory Board (Environmental Engineering Committee) between 2010 and 2015 and a member of the Science Advisory Board's Scientific and Technological Achievement Awards Committee between 2011 and 2016.

He is an Executive Board member of Environmental Research Letters, editorial advisory board member of the Journal of Industrial Ecology, and past Associate Editor of the Journal of Infrastructure Systems. He was a Council Member of the International Society for Industrial Ecology between 2014 and 2016.

He is a frequent consultant to industry and government agencies.

Arpad Horvath is the author of 115+ peer-reviewed papers in the top journals. Among several conference organization roles, he was Conference Chair of the 6th International Conference on Industrial Ecology in 2011, the world’s largest conference in sustainability research to that date.

Arpad Horvath is a recipient of the International Society for Industrial Ecology’s Laudise Prize, the American Society of Civil Engineers’ Huber Civil Engineering Research Prize, the UC Berkeley Chancellor's Sustainability Award, and the Excellence in Review Award from Environmental Science & Technology. Three of his papers have been voted into the top three papers in Environmental Science & Technology in 2008, 2011, and 2012.

Organizing Committee

Brendan O'Connor, *North Carolina State University*

Dr. O'Connor is interested in fabrication, characterization, and modeling of organic electronic devices. Organic semiconductors have enormous potential to transform how we interact with electronics, with wide-ranging application opportunities including low-cost solar power, biocompatible electronics, and ubiquitous integration of electronics into our surroundings (the internet of things). Current research interests in Dr. O'Connor's group include the development of robust flexible and stretchable devices, producing devices with unique capabilities, and establishing scalable processing methods. Devices of interest include solar cells, photodetectors, transistors, and thermoelectrics.

Sybil Sharvelle, *Colorado State University*

Dr. Sybil Sharvelle is an Associate Professor in the Civil and Environmental Engineering Department at Colorado State University with expertise in resource recovery. She received her doctoral degree from Purdue University, where she developed a biological processor for treatment of graywater for potable reuse during long duration space missions. This experience led to her current interest in sustainable concepts for water and waste management. Dr. Sharvelle has 18 years of experience working on resource recovery systems including recycled water, waste conversion to methane and high value organic products, and nutrient recovery from waste material.

Anu Ramaswami, *Princeton University*

Anu Ramaswami, Ph.D., is a professor at Princeton University in the departments of India studies, civil and environmental engineering, and at the High Meadows Environmental Institute. She is an interdisciplinary environmental engineer recognized as a pioneer and leader on the topic of sustainable urban infrastructure systems. Her work explores how seven key sectors – that provide water, energy, food, buildings, mobility, connectivity, waste management and green/public spaces – shape human and environmental wellbeing, from local to global scales. Ramaswami's work integrates environmental science and engineering, industrial ecology, public health and public affairs, with a human-centered and systems focus. She is the inaugural director of the M.S. Chadha Center for Global India at Princeton University, the lead principal investigator and director of the National Science Foundation (NSF)-supported Sustainable Healthy Cities Network, and serves on the United Nations Environment's International Resource Panel and the US NSF's Advisory Committee for Environmental Research and Education.

Benoit Gabrielle, *EcoSys Joint Research Unit, AgroParisTech*

Benoît GABRIELLE: currently research professor of environmental biophysics at the Paris Institute of Life and Environmental Sciences (AgroParisTech), he joined the French National Institute for Agricultural Research (INRA) after a Ph.D. on the environmental balance of oilseed rape in the context of biodiesel production. He is affiliated with a research unit focusing on the functional ecology of agro-ecosystems, located in the Paris area.His research interests include the biophysical modelling of agro-ecosystems, the environmental assessment of arable and energy crops, and the sustainability analysis of bioenergy chains and urban agriculture systems through life-cycle approaches. He is currently coordinating a flagship programme on land-based climate mitigation measures, as part of the CLAND Convergence Institute in France. He is also the Director of the Biosphera Graduate School of life, agricultural and environmental sciences of the newly launched Paris-Saclay University, the top French university in science and technology.

Kara Nelson, *University of California, Berkeley*

Dr. Kara Nelson is a Professor of Environmental Engineering and Associate Dean of Equity and Inclusion in the College of Engineering at U.C. Berkeley. She teaches courses on innovation in the water sector, drinking water and wastewater treatment processes, and pathogen detection and inactivation, taking into consideration the wide range of contexts that exist in low to high-income countries. Her research program investigates innovative strategies to improve the Sustainability of urban water infrastructure, including practices for water reuse, disinfection, nutrient recovery, and international WASH (water, sanitation, and hygiene). She leads the engineering research thrust at ReNUWIt (Reinventing our Nation's Urban Water Infrastructure), and previously served on the expert panel advising the State of California on criteria to regulate indirect and direct potable water reuse. As Associate Dean, she ensures that equity and inclusion are embedded throughout the College's programming and leads efforts to diversify the College and create a climate in which everyone can reach their full potential.

Matthew Potts, *University of California, Berkeley*

Matthew Potts has a broad interdisciplinary background with training in mathematics, ecology and economics with a BS from the University of Michigan and a PhD from Harvard University. He has extensive international experience conducting field research in tropical forests throughout the world. His varied research interests include spatial aspects of forest management and land-use planning as well as how human actions, values, and ethics affect biodiversity conservation.

Debalina Sengupta, *Texas A&M Engineering Experiment Station - Gas and Fuels Research Center*

Dr. Sengupta's research focuses on Sustainability in the context of process systems engineering. She has worked on process design, integration, intensification, optimization, life cycle assessment and other related concepts for Sustainable Supply Chain Design of Biofuels, Natural Gas, and Consumer Products, and decision-making in Sustainability using metrics and indicators. She has also been actively involved in the development of educational modules for sustainable manufacturing. Dr. Sengupta is currently appointed as the Associate Director of the TEES Gas and Fuels Research Center, Water, Energy and Food Nexus Coordinator at Texas A&M Energy Institute, and Lecturer at Texas A&M University, Artie McFerrin Department of Chemical Engineering.

TECHNICAL PROGRAM

FEBRUARY 10th, 2021 (Eastern Time Zone)

10:00 AM	10:10 AM	Introduction to Day 1: Arpad Horvath (University of California, Berkeley)
10:10 AM	10:40 AM	*Leveraging the Urban Food-Energy-Water Nexus for Sustainability and Health* Keynote Speaker: **Anu Ramaswami**, Princeton University
10:40 AM	11:10 AM	*Connecting the Dots Among Food, Energy, and Water Needs* Keynote Speaker: **Paolo D'Odorico,** University of California, Berkeley
11:10 AM	11:20 AM	Break
11:20 AM	12:40 PM	***Urban and Controlled-Environment Agriculture***
11:20 AM	11:40 AM	*Organic Solar Power Integrated Greenhouses: Challenges and Opportunities* **Session Lead: Brendan O'Connor,** North Carolina State University
11:40 AM	11:55 AM	*Environmental Evaluation of Urban Agriculture: Methods and Case Studies* **Erica Dorr,** AgroParisTech
11:55 AM	12:10 PM	*Organic Solar Powered Greenhouses: Balancing Crop Production and Energy Harvesting* **Eshwar Ravishankar,** North Carolina State University
12:10 PM	12:25 PM	*Assessing the Edible City* **Benjamin Goldstein,** McGill University
12:25 PM	12:40 PM	Discussion - Moderator: Brendan O'Connor (North Carolina State University)
12:40 PM	12:50 PM	Break
12:50 PM	2:10 PM	***Food Waste***
12:50 PM	1:10 PM	*Halving U.S. Food Waste by 2030* **Session Lead: Katy Franklin,** ReFED
1:10 PM	1:25 PM	*Creating a Sustainable Food Waste Management Ecosystem* **Callie Babbitt,** Rochester Institute of Technology
1:25 PM	1:40 PM	*Case Studies of Integrated Food, Energy and Water Conservation Yielding Quantified Economic, Social and Environmental Gains* **Bruce Taylor,** Enviro-Stewards, Inc.
1:40 PM	1:55 PM	*We All Do It -- Wasting Food in U.S. Households* **Laura Moreno,** CalRecycle
1:55 PM	2:10 PM	Discussion - Moderator: Callie Babbit (Rochester Institute of Technology)
2:10 PM	2:20 PM	Break
2:20 PM	3:25 PM	***FEW Societal Nexus***
2:20 PM	2:40 PM	*Meeting Global Food Consumption, Nutritional, and Environmental Health Standards: A U.S. Case Study across Racial and Ethnic Subgroups* **Session Lead: Joe Bozeman,** University of Illinois, Chicago
2:40 PM	2:55 PM	*Policy Imperatives and Implementation Mechanisms to Reform the Practices of Engineering Design for Authentic and Realistic Cooperation with the Landscape Design, Architecture and Urban Planning Communities of Practice* **David Benjamin**, Aqua Naturae
2:55 PM	3:10 PM	*Abrupt Transformations of Food Supply and Demand Networks and Interconnected Water and Energy in the COVID-19 Pandemic* **Rae Zimmerman,** New York University
3:10 PM	3:25 PM	Discussion - Moderator: Joe Bozeman (University of Illinois, Chicago)

FEBRUARY 11th, 2021 (Eastern Time Zone)

10:00 AM	10:05 AM	Introduction to Day 2: Arpad Horvath (University of California, Berkeley)
10:05 AM	10:35 AM	*A Global Perspective on Wastewater as an Agricultural Resource: Knowledge Gaps and Opportunities* **Keynote Speaker: Kara Nelson,** University of California, Berkeley
10:35 AM	11:05 AM	*Negative Emissions, and a Glimpse into the Climate-FEW Nexus* **Keynote Speaker: Benoit Gabrielle**, AgroParisTech
11:05 AM	11:15 AM	Break
11:15 AM	12:35 PM	***FEW Issues in Arid Regions***
11:15 AM	11:35 AM	*Resilient FEW Nexus Systems for Arid Regions* **Session Lead: Debalina Sengupta,** Texas A&M University
11:35 AM	11:50 AM	*Resource Management in Arid Regions for Sustainable FEW Nexus* **Dhabia Al-Mohannadi,** Texas A&M University Qatar
11:50 AM	12:05 PM	*Project Wadi Attir: An Experiment with Community-Based, Dryland Sustainable Development* **Michael Ben-Eli,** The Sustainability Laboratory
12:05 PM	12:20 PM	Integrated Water Management at the Peri-Urban Interface **Bridget Gile,** Stanford University
12:20 PM	12:35 PM	Discussion - Moderator: Debalina Sengupta (Texas A&M University)
12:35 PM	12:45 PM	Break
12:45 PM	2:20 PM	***Sustainability and Life Cycle Assessment***
12:45 PM	1:05 PM	*Sustainability Assessment Beyond Carbon* **Session Lead: Emily Grubert,** Georgia Institute of Technology
1:05 PM	1:20 PM	*Our Research on Urban LCA* **Maxime Trocmé,** Vinci
1:20 PM	1:35 PM	*Biogenic Carbon Accounting in LCA* **Jordan Chamberlain,** WSP
1:35 PM	1:50 PM	*What Contributes to Food-Related Emissions?* **Yuwei Qin and Arpad Horvath,** University of California, Berkeley
1:50 PM	2:05 PM	*Mapping the Food Waste-Energy-Water-Emissions Nexus at Commercial Kitchens: A Systems Approach for a More Sustainable Food Service Sector* **Shauhrat Chopra**, City University of Hong Kong
2:05 PM	2:20 PM	Discussion - Moderator: Emily Grubert (Georgia Institute of Technology)

FEBRUARY 12th, 2021 (Eastern Time Zone)

10:00 AM	10:05 AM	Introduction to Day 3: Arpad Horvath (University of California, Berkeley)
10:05 AM	10:35 AM	*Integration of Technological Innovation and Policy Solutions for Food-Energy-Water Resource Use Efficiency* **Keynote Speaker: Sybil Sharvelle,** Colorado State University
10:35 AM	11:05 AM	*Weighing Life-Cycle Climate and Public Health Tradeoffs in Organic Waste Management* **Keynote Speaker: Corinne Scown,** Lawrence Berkeley National Laboratory
11:05 AM	11:15 AM	Break
11:15 AM	12:40 PM	***Energy Focus of the FEW Equation***
11:15 AM	11:35 AM	*The Energy-Water Nexus at Home: Energy and Water in the Residential Environment* **Session Lead: Ashlynn Stillwell**, University of Illinois, Urbana-Champaign
11:35 AM	11:55 AM	*Opportunities for using Food Waste for Bioenergy and Carbon Sequestration* **Hanna Breunig**, Lawrence Berkeley National Laboratory
11:55 AM	12:10 PM	*System-wide Economic and Emissions Optimization of Organic Waste Recycling Infrastructure in California* **Sarah J. Smith**, Lawrence Berkeley National Laboratory
12:10 PM	12:25 PM	*Getting to Zero: Will Biogas from Organic Waste in US Cities be Part of a Decarbonized Future?* **Yael R. Glazer & Emma Laub**, University of Texas, Austin
12:25 PM	12:40 PM	Discussion - Moderator: Corinne Scown (Lawrence Berkeley National Laboratory)
12:40 PM	12:50 PM	Break
12:50 PM	2:10 PM	***Technological Solutions for Efficient FEW Management***
12:50 PM	1:10 PM	*Advancing Membrane Technologies for Sustainable Nitrogen and Phosphorous Recovery from Human Urine* **Session Lead: Ngai Yin Yip**, Columbia University
1:10 PM	1:25 PM	*Reducing Energy and Water Consumption in the Process Industries Through Process Intensification and Modular Manufacturing* **Paul Yelvington,** RAPID Institute, AIChE
1:25 PM	1:40 PM	Novel and Sustainable Pathways for Producing Hydrogen with Inherent Carbon Removal from Aqueous Biomass Oxygenate Precursors **Greeshma Gadikota,** Cornell University
1:40 PM	1:55 PM	*Black Swan Cycle for Food-Energy-Water Sustainability and Carbon Neutrality* **Brian Kolodji,** Black Swan, LLC
1:55 PM	2:10 PM	Discussion - Moderator: Ngai Yin Yip (Columbia University)
2:10 PM	2:25 PM	*Teaching FEW Sustainability to Undergraduate Students* **Sanjiv Gokhale,** Vanderbilt University
2:25 PM	2:35 PM	Closing remarks

CODE OF CONDUCT

AIChE's volunteers are the core of the Institute and make all of its programs, conferences and educational efforts possible. These offerings provide excellent opportunities for AIChE members and meeting attendees to gain greater technical expertise, grow their networks, and enhance their careers. AIChE events provide engineers, scientists, and students a platform to present, discuss, publish and exhibit their discoveries and technical advances.

At all times, volunteers and meeting attendees should act in accordance with AIChE's Code of Ethics, upholding and advancing the integrity, honor and dignity of the chemical engineering profession. AIChE's Board of Directors has developed these guidelines to foster a positive environment of trust, respect, open communications, and ethical behavior. These guidelines apply to meetings, conferences, workshops, courses and other events organized by AIChE or any of its entities and also to volunteers who conduct other business and affairs on behalf of AIChE.

SPECIFICALLY:

1. Volunteers and meeting attendees should understand and support AIChE's Code of Ethics.
2. Volunteers and meeting attendees should contribute to a collegial, inclusive, positive and respectful environment for fellow volunteers and attendees, and other stakeholders, including AIChE staff.
3. Volunteers and meeting attendees should avoid making inappropriate statements or taking inappropriate action based on race, gender, age, religion, ethnicity, nationality, sexual orientation, gender expression, gender identity, marital status, political affiliation, presence of disabilities, or educational background. We should show consistent respect for colleagues, regardless of discipline, employment status, and organizations for which they work, whether industry, academia, or government.
4. Disruptive, harassing or other inappropriate statements or behavior toward other volunteers, members, and other stakeholders, including AIChE staff, is unacceptable.
5. Volunteers and meeting attendees should obey all applicable laws and regulations of the relevant governmental authorities while volunteering or attending meetings. Volunteers and meeting attendees taking part in any AIChE event, including the Chem-E-Car Competition®, should also comply with all applicable safety guidelines.

Any violations of the foregoing should be reported to the President or the Executive Director of the Institute.

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