

BOSTON UNIVERSITY INSTITUTE FOR SUSTAINABLE ENERGY

Annual Report | 2021



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Boston University
 Institute for Sustainable Energy
 Annual Report
2021

ISE research on
 clean manufacturing,
 city climate action,
 and ESG investing

7



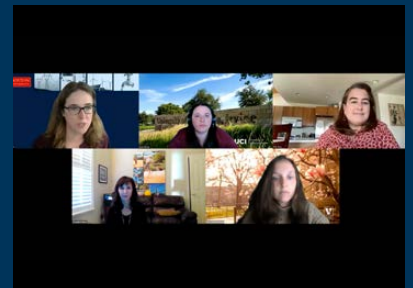
Cross-sector
 collaborations

17



Energy of the
 Future webinar
 series

19



COVER: IMAGE BY 9COMEBACK/SHUTTERSTOCK.COM

INSIDE FRONT COVER: PHOTOS BY IQONCEPT/SHUTTERSTOCK.COM (TOP),
 COURTESY OF EARTHDAY.ORG (MIDDLE)

FOLLOWING PAGE: PHOTO BY LIZ LINDER

LETTER FROM THE DIRECTOR

Dear ISE Friends and Colleagues:

Like many of you, I've long since lost count of the number of times I've told myself how unbelievable the last year has been. We've been permanently saddened by the scale of the pandemic's harm, falling disproportionately on vulnerable populations while we fortunate white-collar researchers continued our work, largely out of harm's way. We have also been heartened by the immense courage of all the frontline workers who kept healthcare and our essential services flowing. For many of them, we know the pandemic's toll is far from over, and we can only express our thanks.

Although clearly it was a year like no other, the ISE's mission and work were, if anything, reinforced by the pandemic as well as the highly visible racial injustice of the last year and the ever more visible effects of climate change. The realization that sustainable energy and climate solutions are at the core of a just and healthy future is now more widely accepted than ever. Despite this difficult year, our work on sustainable energy and water systems, clean mobility, and sustainable financial markets was able to maintain its momentum and, in some cases, even grow. Thanks to the remarkable resilience of the ISE's affiliated faculty and staff, we published 11 white papers or articles, had the best-attended events in our history, and received very good media coverage for our work. We hired half a dozen new staff members and students, including a new executive director for the IMAP sustainable finance program we run jointly with Questrom's Susilo Institute.

During this year the university also completed its ten-year strategic plan. We were honored that our own Jacquie Ashmore was chosen to represent sustainability research in the planning effort, and then we were honored again when the university chose to make sustainability one of its core themes for the coming era. As part of this effort, the ISE will be expanding into a larger sustainability institute—a change that holds incredible potential for expanding BU's contribution to one of the great challenges of our era. The expanded research institute will complement many other important sustainability efforts across the university, including a stronger strategic focus on the issue at Questrom, Engineering, the College of Arts and Sciences, the College of Communication, the School of Public Health, as well as the campus-wide climate action plan and curriculum development. This is an exciting time for sustainability research and engagement across the university.

It has been a great pleasure to lead the ISE through the last six years and build a research community and superb staff that helped establish us as a respected source of ideas and engagement. I am confident that the institute's next era will be even more successful.

Sincerely Yours,

Peter Fox-Penner

Dr. Peter Fox-Penner
Director, Boston University Institute for Sustainable Energy



HIGHLIGHTS OF FY2021

INSTITUTE FOR SUSTAINABLE ENERGY AT A GLANCE

63

Affiliated Faculty Members

\$1.28M

Total Funding

19

Senior Fellows

11

Published Reports

37

Archival Publications

80

Events (Hosted or Speaker)

4

Research Focus Areas

Advising Federal Policymakers

Seizing new opportunities to advise a seismic shift in U.S. energy and climate policy under the Biden administration, the ISE hosted three events with top federal policymakers who are leading the charge on clean economic growth and job creation. Amid early speculation about an infrastructure bill in January, U.S. Representative Sean Casten (D-IL) shared insights from Capitol Hill as national interest spiked in the days after President Biden's executive order on tackling the climate crisis. Senator Ed Markey (D-MA) later joined Congressman Casten in making opening remarks for the ISE's spring congressional briefing on clean energy investments, hosted in partnership with BU Federal Relations, saying "This Boston University event with an incredible panel of scholars and experts shows why Massachusetts is not just the Bay State, it's the brain state." In June, Jane Flegal, the first-ever Senior Director for Industrial Emissions in the White House Council on Environmental Quality, together with Congressman Paul Tonko (D-NY) commended the ISE's report for policymakers on U.S. clean manufacturing innovation, published jointly with the Information Technology & Innovation Foundation and Fraunhofer USA Center for Manufacturing Innovation.

Groundwork for Growth

The ISE held steady financially during a tumultuous year. The Institute laid the groundwork for the growth of the ISE in the coming year and beyond through the strategic planning process, and by incubating several projects for which the ISE is now pursuing foundation and federal funding. Additionally, the Impact Measurement & Allocation Program (IMAP), co-led by the ISE and Susilo Institute for Ethics at the Questrom School of Business, was fortunate to receive a second \$500K philanthropic gift to support its activities.

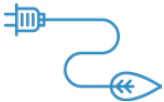
Research to Improve ESG Metrics

BU's ESG impact investing research program is off to a strong start in its first year with the hire of IMAP Executive Director Susan Fredholm Murphy, who joins Co-Directors Nalin Kulatilaka (Susilo Institute Co-Director) and Peter Fox-Penner (ISE Director) in leading the program. The IMAP also draws on the guidance of its distinguished advisory board, whose finance industry experience includes leadership positions at Boston Common Asset Management, Calvert Research and Management, Daybreak Partners, Nordea Asset Management, and Russell Investments. The program is now funding BU-led academic research projects with awards up to \$250,000. So far it has supported three projects led by BU faculty and directly funded six BU students enrolled in five different academic programs.



MISSION & CORE RESEARCH

The Boston University Institute for Sustainable Energy (ISE) translates sustainable energy research into urgent action. The ISE is a university-wide center dedicated to developing energy systems that will provide abundant, universally accessible, and sustainable energy sources for emerging and advanced economies. Our approach combines interdisciplinary research, policy analysis, and collaborative engagement with partners at every level—from individual energy and water utilities to cities, states, and countries.



ENERGY SYSTEMS OF THE FUTURE

Energy production is the largest global source of greenhouse gas emissions, making transformation of the power grid a critical step in accelerating our progress toward a clean energy future. The ISE advises the energy industry, regulators, and policymakers on the wide-ranging changes needed to meet unprecedented demand for large-scale electrification to drive this transition and enable the global community to achieve its ambitious climate goals over the coming decades. Research topics include energy storage, clean manufacturing, microgrid development, emission regulations, and global access to electricity.



SUSTAINABLE WATER MANAGEMENT

The water-energy nexus is key to a clean energy future. The ISE's applied research examines the connections between water and energy infrastructure planning, efficiency, conservation, and affordability while considering critical, evolving risks such as climate change. As part of the national One Water movement, the ISE's work provides a critical analysis of integrated approaches that promote both sustainable energy management and responsible water stewardship for communities and utilities.



SUSTAINABLE CITIES

The United Nations projects 68% of the world's population will live in urban areas by 2050. The ISE leads research into new methods of urban planning and implementation to create vibrant, sustainable communities that offer a high quality of life for everyone. The ISE supports city leaders by advising climate action plans and strategies developed to achieve net-zero goals, including the expansion of renewable energy systems, an increase in carbon-free public transit, and greater energy efficiency in new and existing buildings and infrastructure.



SUSTAINABLE FINANCE

Environmental, social, and corporate governance (ESG) factors are becoming a greater priority for business leaders and investors. This creates an opportunity to accelerate social good and large-scale climate action from the world's largest corporations. The ISE's research through the Impact Measurement & Allocation Program (IMAP), in collaboration with the Susilo Institute for Ethics in the Global Economy, aims to help define a uniform set of metrics for the growing field of sustainable investing. The IMAP's work will streamline existing frameworks and criteria to allow markets, companies, utilities, and investors to evaluate an organization's ESG in a reliable, universal way.

SUSTAINABILITY RESEARCH INSTITUTE

Boston University's 2020 Strategic Plan was framed with the tagline "Accelerating the Future" and included the development of a university-wide initiative on sustainability, with a primary focus on research but also support for three other strategic priorities: the academic experience, building the BU community, and ensuring diverse participation.

We live in a moment of overwhelming change, with our regular everyday lives, key institutions, and our economy shaken by the impact of COVID-19 and a deep reckoning with systemic racism. Along with the profound immediate challenges this poses, these blows to our established norms prompt a deep reflection on what future world we want to inhabit and create. This opens up a notable opportunity for revitalization of the pursuit of a healthy, just, and sustainable world.

Responding to these challenges and opportunities will require an unprecedented amount of pathbreaking research as well as deep engagement between the academic community and the rest of society, especially policymakers. Moreover, the interconnected, uniquely complex challenges of sustainability require research that spans and integrates many traditional academic subject areas. Impactful sustainability research will require integrated efforts that cross departmental boundaries and leverage the full range of expertise and disciplinary viewpoints found in a modern research university.

The Sustainability Research Institute (SRI) is an interdisciplinary, university-wide

institute designed to address critical aspects of the urgent sustainability challenges that confront our world today and to support BU researchers in contributing to impactful solutions. It will be a hub that expands the research enterprise through seed grants, support for large grant proposals, and local and global partnerships. It will convene researchers from BU and stakeholders and practitioners from beyond BU to facilitate translational research that is solutions-oriented.

Beyond its research emphasis, the SRI will contribute to training students and future researchers and practitioners. It will build community on multiple scales, spanning the local level, both on campus and with the City of Boston, to global partnerships starting with key academic partners. It will address diversity and equity in research through broader activities, including outreach and communications and in the representation of people who are part of and connected to the organization.

The plan is designed to ensure that BU draws on its current distinctive advantages—emphasizing the connection between the natural sciences, social sciences, public health, and business along with technology—and continues to differentiate its future research efforts in these areas. With BU's strong culture of interdisciplinarity, establishing the SRI will ensure that BU is at the forefront of academic institutions working to address sustainability challenges with outcomes-driven research that is impactful and will support the training of researchers and future practitioners whose work in the coming decade will be critical to building a just and sustainable world.

FEATURED RESEARCH PROJECTS

■ U.S. CLEAN MANUFACTURING INNOVATION

Manufacturing is predicted to become the sector with the largest greenhouse gas emissions in the U.S., yet national plans to achieve net-zero emissions have so far not focused on retooling the difficult-to-decarbonize manufacturing industries. The ISE, in partnership with the Fraunhofer USA Center for Manufacturing Innovation (CMI) at Boston University and Information Technology & Innovation Foundation (ITIF), jointly published a report on the U.S. clean manufacturing innovation agenda that identifies four segments of the manufacturing sector that have high potential to mitigate greenhouse gases and create many new manufacturing jobs. The report was based in part on the results of four workshops that assembled leading academic experts on manufacturing decarbonization from all over the world.

WORKSHOP SERIES

[Widening the Lens on Innovation for Clean Manufacturing](#)
January 27–February 17, 2021

One hundred highly distinguished speakers and attendees discussed the state-of-the-art in manufacturing—including low-temperature processes, high-temperature processes, biological solutions, and materials substitution—to help guide the research working group’s recommendations to policymakers. The series produced a robust resource of 25 workshop presentation recordings with technical summaries on each topic, all available on the ISE’s website.

Workshop Speaker Organizations: 50001 Strategies | BioMADE | Carbon Leadership Forum | Clemson University | Covington & Burling LLP | EnginZyme | Fraunhofer Institute for Solar Energy Systems | Fraunhofer Institute for Systems and Innovation Research, Germany | Fraunhofer USA CMI | Global Efficiency Intelligence | Heat X | ITIF | Lawrence Berkeley National Laboratory | Massachusetts Institute of Technology | National Renewable Energy Laboratory | Nel Hydrogen | Oak Ridge National Laboratory | QuesTek Innovations | Riffyn | Texas A&M University | The Good Food Institute | Ultra-sonic Technology Solutions | University of Texas at Austin | U.S. Army Corps of Engineers | U.S. Department of Energy | Worcester Polytechnic Institute

REPORT

[Clean and Competitive: Opportunities for U.S. Manufacturing Leadership in the Global Low-Carbon Economy](#)

June 21, 2021

The published report calls for an integrated national strategy to address the twin challenges of bolstering the U.S. manufacturing sector and averting climate change. Timely federal RD&D and deployment policies targeted to specific manufacturing industries could create competitive advantage, expanding domestic investment and employment.

“One of the things I love about this report is the way it weaves together two challenges that are far too often treated separately—revitalizing domestic manufacturing and decarbonizing industry.”

**Jane Flegal, Senior Director for Industrial Emissions,
White House Council on Environmental Quality**

The report identifies four examples of industries where the U.S. could unite manufacturing and climate policy to increase competitiveness while fighting against climate change: clean hydrogen production; next-generation heat pumps, novel drying technologies, and related innovations; clean chemical manufacturing; and biotechnology-based proteins. The report is co-authored by ISE Director Peter Fox-Penner, ITIF’s David M. Hart, ISE Senior Fellow Henry Kelly, ISE Research Assistant Ryan C. Murphy, ISE Senior Fellow Kurt Roth, ISE-affiliated faculty Andre Sharon, and Colin Cunliff, formerly of ITIF.

The report received high praise from Capitol Hill and White House policymakers in keynote remarks that kicked off the panel discussion of the report’s findings, [How to Make U.S. Manufacturing Clean and Competitive in the Global Low-Carbon Economy](#) on June 24, 2021.

Following the public launch, the project also provided briefings to a large group of House and Senate committee staff members, the U.S. Department of Energy, and other federal agencies and policymakers.

■ EQUITABLE CITY CLIMATE ACTION

The ISE advanced its research focus on sustainable cities this year, shifting to address the challenges and opportunities for city climate action as the pandemic dealt blows to public health and the economy and highlighted the vast inequities and injustice that is today's legacy of systemic racism. In the lead-up to the 2021 UN Climate Change Conference (COP26), taking place in November 2021, the ISE also focused on new opportunities for more ambitious city climate action under a supportive federal administration.

POST-PANDEMIC RECOVERY

COVID & Climate: What's Next for Cities?

The first of the three reports in the [COVID & Climate: What's Next for Cities?](#) series delineated the numerous similarities, as well as a few differences, between the global crises of COVID-19 and climate change and presented four lessons for city climate leaders. The second report pointed to ways that cities can meet the challenges of accelerating climate action, with a focus on the preexisting inequity in and access to essential services—including housing, affordable clean energy, transportation and mobility, and green space—and the connection to public health, climate change mitigation, adaptation, and resilience. In the third and final report, the ISE presented the results of a survey of 25 U.S. and Canadian city climate leaders, conducted in July and August 2020, to assess the current priority of city climate action in the context of the pandemic. The ISE collaborated with BU's Initiative on Cities and the Innovation Network for Communities on the series.

RACE TO ZERO

Accelerating Cities' Net Zero Action

The “Race To Zero” global campaign, the largest ever of its kind, rallies leadership and support among cities, regions, businesses, and investors for a healthy, resilient, zero-carbon recovery committed to net-zero goals by 2050. Working with the UK Government to encourage more cities to participate in making net-zero commitments ahead of COP26 in Glasgow, the ISE engaged with 34 city leaders through the collaboration. The project convened two virtual “visioning lab” discussions, one focused on the impact of partnerships and the other on emerging opportunities in financing, to promote cross-learning and collaboration on climate action between cities in North America and the UK. Drawing on insights from these visioning labs and interviews with city leaders, the ISE and the UK Government jointly released the summary report [Accelerating Cities' Net Zero Action](#) in partnership with the UN Climate Change Conference UK 2021, C40 Cities, Place-Based Climate Action Network, and MetroLab Network.



NBC10 Boston, Adjusting to Climate Change: Closing the Climate Gap in Black Communities, July 23, 2020 with ISE Associate Director Cutler Cleveland and U.S. Representative Ayanna Pressley

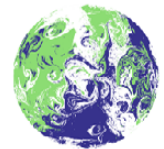
Accelerating Cities' Net Zero Action

Key takeaways from partnership and innovative financing visioning labs

May 2021



Boston University Institute for Sustainable Energy



UN CLIMATE CHANGE CONFERENCE UK 2021

IN PARTNERSHIP WITH ITALY



UK Government



PLACE-BASED CLIMATE ACTION NETWORK



■ IMPROVING SUSTAINABLE INVESTING

In its first year, BU's Impact Measurement & Allocation Program (IMAP) has made solid strides toward realizing its ambitious research agenda to help the financial industry better measure the impact of their investments through environmental, social, and governance (ESG) metrics. Awareness that such ESG metrics can be material to corporate investment returns has been growing rapidly within the industry. Over \$1 trillion in assets are now managed under "Impact Funds" and more than 5,000 asset owners and managers overseeing over \$89 trillion in assets have signed the UN Principles for Responsible Investment (PRI). However, ESG metrics available today are often inconsistent and incomplete.

The IMAP's goal is to support real change in corporate behavior and asset management decision-making. To do this, the program—jointly led by the ISE and Questrom's Susilo Institute for Ethics in the Global Economy—has built strong connections between interdisciplinary academic teams and industry experts poised to put solutions into practice.

On the program's first anniversary, IMAP Executive Director Susan Fredholm Murphy, who joins Co-Directors Nalin Kulatilaka (Questrom Professor) and Peter Fox-Penner (ISE Director) in heading the program, reflected on what led her to focus on this sustainability challenge and what's ahead.

Tell us a little about your background.

I'm an engineer who has long been interested in sustainability. I studied mechanical engineering with a materials science focus at Olin College of Engineering and then completed a master's program in technology and policy at MIT. I appreciated the degree to which both highly technical programs also incorporated the broader context surrounding engineering design and decisions. Many programs teach the technical aspects of engineering, but legal, social, economic, and environmental constraints can also have a huge effect on the success of new technologies. I enjoy trying to solve such interdisciplinary problems.

Before joining BU, I spent 12 years in environmental sustainability consulting, most recently as the Director of Consulting and Innovation for the Americas branch of the German firm Thinkstep. My expertise there was in calculating something akin to a nutrition label that described the environmental footprint of products. During this time, I helped develop both the software tools and the industry rules required to facilitate such calculations.

What attracted you to join the IMAP and the ISE?

I believe it is important to quantify—and make easily accessible—environmental, sustainability, and social impact data. When such data is available, people make better decisions. I spent a long time developing environmental



*Susan Fredholm Murphy,
IMAP Executive Director*

data and tools that were primarily used by other engineers in my consulting days. Now that the financial industry is seriously interested in these topics, there is an opportunity to do much more and have a greater impact on the sustainability of our economy.

How did you arrive at initially prioritizing carbon accounting/climate risk and human capital ESG metrics?

These two topics emerged quickly as priorities in both our conversations with industry professionals and with the academic researchers interested in working with the IMAP.

More and more companies realize they need to understand the physical risks of climate change on their business as well as the risks of a society transitioning to a lower carbon-impact economy. There has been a lot of work on measuring carbon impacts in many disciplines, but most of this has not yet been translated into a set of tools that works well within the financial industry. For our first research project, we are trying to answer the question of which corporations are likely to meet their future carbon targets. We've seen a recent proliferation of companies setting future carbon emissions targets, some of which are aligned with other initiatives such as the Science Based Targets Initiative (SBTi) or the Paris Accord, and many of which are not. The last decade has shown us that while some companies take the necessary steps to achieve such targets, others have yet to "walk the talk."

With respect to human capital, there is far less research available here primarily because there has been far less data collection on these topics. The pandemic has highlighted discrepancies in how employees are treated and which companies are now struggling to rehire talent. Investors want more insight into these risks.

What are your big-picture aspirations for the program as research ramps up?

We will help to identify ESG metrics of importance and ways in which such data can be collected and shared for optimal use. I am excited about both the number and professional diversity of people interested in working with us on this program. Our faculty and students are coming not just from the Questrom School of Business but from the School of Law, the Earth & Environment Department, and across BU. I want the IMAP to become a key resource for facilitating dialogue between academics and practitioners on ESG challenges. We will then use these diverse interlinkages to create meaningful changes.

PUBLISHED REPORTS

Research	Authors	Type	Research Area
<u>Clean and Competitive: Opportunities for U.S. Manufacturing Leadership in the Global Low-Carbon Economy</u>	Peter Fox-Penner, Henry Kelly, Ryan C. Murphy, Kurt Roth, Andre Sharon (ISE); David M. Hart, Colin Cunliff (ITIF)	Paper/Report	Energy Systems of the Future
<u>Accelerating Cities' Net Zero Action</u>	Jacque Ashmore and Taylor Dudley	Paper/Report	Sustainable Cities
<u>EPA Methane Emission Controls, Obama vs Trump vs Biden: What Needs to Be Fixed and What Should Be Left Alone</u>	Robert Kleinberg	Paper/Report	Energy Systems of the Future
<u>Evaluating Emissions Reductions from Zero Waste Strategies under Dynamic Conditions: A Case Study from Boston</u>	Joshua R. Castigliero, Adam Pollock, Cutler J. Cleveland, Michael J. Walsh	Journal (Waste Management)	Sustainable Cities
<u>Quantifying Scope 3 Emissions Associated with Employee Travel at Boston University</u>	Olivia Henning, Lucia Vilallonga, Jacquie Ashmore	Paper/Report	Energy Systems of the Future
<u>The Global Warming Potential Misrepresents the Physics of Global Warming Thereby Misleading Policy Makers</u>	Robert Kleinberg	Paper/Report	Energy Systems of the Future
<u>A Survey of North American City Climate Leaders: The Prospects for Climate Action in the COVID-19 Era</u>	Ardeth Barnhart, Jacquie Ashmore, Alicia Zhang, Cutler Cleveland, Taylor Dudley (ISE); Katharine Lusk (Initiative on Cities); Peter Plastrik, John Cleveland (Innovation Network for Communities)	Paper/Report	Sustainable Cities
<u>Scenarios, Sustainability, and Critical Infrastructure Risk Mitigation in Water Planning</u>	David Jermain	Paper/Report	Sustainable Water Management
<u>Water Planning in an Age of Change</u>	David Jermain	Paper/Report	Sustainable Water Management
<u>The Value of Diversifying Uncertain Renewable Generation through the Transmission System</u>	Johannes Pfeifenberger, Pablo Ruiz (ISE); Kai Van Horn (National Grid USA)	Paper/Report	Energy Systems of the Future
<u>Climate of Crisis: How Cities Can Use Climate Action to Close the Equity Gap, Drive Economic Recovery, and Improve Public Health</u>	Cutler Cleveland, Jacquie Ashmore, Ardeth Barnhart, Taylor Dudley, Matthew Lillie, Alicia Zhang (ISE); Katharine Lusk (Initiative on Cities); Peter Plastrik, John Cleveland (Innovation Network for Communities)	Paper/Report	Sustainable Cities

UNIVERSITY COLLABORATIONS

■ COLLEGE OF ARTS & SCIENCES: EARTH & ENVIRONMENT

Professor Anne Short, her graduate student Claudia Diezmartinez Peregrina (both in Earth & Environment), and ISE Executive Director Jacquie Ashmore are formulating a research project examining how small and mid-size cities are learning about, engaging with, and resourcing climate action. The opportunities and constraints in smaller cities are different relative to larger cities, creating a knowledge gap in supporting the decarbonization of all cities that is the motivation for this research. One aspect of particular interest is how climate actions in small or mid-size cities reproduce or challenge existing inequities and vulnerabilities.

■ COLLEGE OF ENGINEERING

The \$5,000 first prize in the second annual Born Global Foundation Competition for Innovation in Sustainability, once again co-sponsored by the ISE and ENG, was awarded for a novel solution to water scarcity in rural Moroccan villages. The winning student team, advised by ISE Executive Director Jacquie Ashmore, mimicked the natural water-trapping capabilities of the Namib Desert beetle to design an array of easily accessible “bio-towers” wrapped in sheets of fog-harvesting mesh that collect water condensation droplets, providing much-needed local water supplies in and around communities. Emily Ryan, ISE Associate Director and ENG Associate Professor of Mechanical Engineering, judged the competition with alum Kimberly Samaha, who heads the foundation that funded the prizes.



“The project-based business model built for this initiative [Impact Measurement & Allocation Program] connects the best of what Questrom and Boston University have to offer. We are very excited by the intellectual leadership of our co-founders and the generous support of our alumni. I am confident that this effort will positively influence investment behaviors and create true societal and environmental change.”

Susan Fournier, Allen Questrom Professor and Dean of Questrom (press release)

■ QUESTROM SCHOOL OF BUSINESS

The ISE and Questrom launched our most ambitious collaboration to date, supported by \$1 million in philanthropic gifts and guided by an advisory board of distinguished practitioners. The jointly led Impact Measurement & Allocation Program (with Questrom’s Susilo Institute) strives to support real change in corporate behavior and asset management through better environmental, social, and governance (ESG) metrics. The ISE’s research synergies with Questrom faculty and students also extended to work on sustainable African electricity sector expansion, city climate action, and distributed energy.

■ COLLEGE OF COMMUNICATION

COM Adjunct Clinical Professor and ISE Senior Fellow Sarah Finnie Robinson, a climate activist and thought leader on impact communication, laid bare what a global emergency is in the Earth Week 2021 COMTalk panel, “How We Talk About Climate Crisis.” Finnie Robinson called on lessons and insights from an expert panel of BU alums from The Nature Conservancy, WCAI, and the NAACP Environmental and Climate Justice Program to explore the connections between the giant systemic issues of climate, health, and environmental and racial justice. Panelists shared perspectives on how these converging crises have shaped communication to influence behavioral transformation and move people to act. Finnie Robinson has also furthered BU’s institutional partnership with Covering Climate

Now, a global journalism initiative of 400 news outlets with a combined audience of nearly two billion people.

■ **FREDERICK S. PARDEE SCHOOL OF GLOBAL STUDIES**

Despite the pandemic making the formation of new collaborative teams more challenging, Jon Greenacre, a new faculty member in the Pardee School, has established a research team that includes Professor Les Kaufman (Biology), Associate Professor Justin Ren (Questrom), Lecturer Richard Stuebi (Questrom), another new faculty member Assistant Professor Abigail Sullivan (Earth & Environment), and ISE Executive Director Jacquie Ashmore (ISE/Earth & Environment). The team is looking to develop a framework that will help distributed energy firms build sales agents in rural, marginalized communities by enabling them to understand the technology, business models, and micro-institutions needed to leapfrog barriers. Micro-institutions are the rules that firms use to adapt their business models to new environments, including rural, marginalized communities.

■ **SCHOOL OF PUBLIC HEALTH**

The threats to human health posed by climate change headlined the 2021 SPH annual Bicknell Lecture, bringing together leading climate experts from across academia, government, and the private sector to discuss “Tackling Climate Change: Mitigation or Adaptation?” ISE Executive Director Jacquie Ashmore joined a follow-on conversation with BU Environmental Health faculty to reflect on the lecture’s insights for a live panel discussion and audience Q&A. For a separate event organized by the Boston Green Ribbon Commission in collaboration with its Higher Education Working Group, “Building an Equitable, Healthy, Climate

Resilient Future for Boston,” the ISE turned to SPH Environmental Health faculty Madeleine Scammell and Jonathan Levy to discuss their research and opportunities for progress. The ISE’s Jacquie Ashmore further supported SPH’s research as a thesis committee member for Kate Connelly, a student working under the supervision of Associate Professor Patricia Fabian studying the impact of climate zones on the indoor environment and energy use in mid-rise multifamily homes, which frequently house lower-income residents.

■ **BU URBAN**

Representatives of the ISE continue to support BU’s URBAN program, an NSF-funded Graduate Program in Urban Geoscience and Environmental Health. ISE Senior Fellow Sarah Finnie Robinson and ISE Executive Director Jacquie Ashmore are both core faculty; in addition, Finnie Robinson is on the internal advisory board. Both participate in regular program meetings that highlight successes and review ideas for new aspects of the program. Ashmore also serves on the thesis committees for two BU URBAN students in the School of Public Health and the Earth & Environment department.

■ **HARIRI INSTITUTE FOR COMPUTING AND COMPUTATIONAL SCIENCE & ENGINEERING**

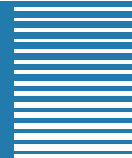
The ISE and Hariri Institute for Computing teamed up this spring to co-host the three-part BU Knowledge Transfer series Sharing Research at the Interface of Data Sciences and Sustainability to facilitate research collaborations among BU faculty. Each 90-minute session featured flash talks from four faculty members across the university, including ISE-affiliated faculty Christos Cassandras, Distinguished Professor

of Systems Engineering and Electrical and Computer Engineering; Cutler Cleveland, ISE Associate Director and Professor, Earth & Environment; Sucharita Gopal, Professor, Earth & Environment; and Thomas Little, Professor of Systems Engineering and Electrical and Computer Engineering. Event topics encompassed smart cities and sustainability, computing and technology in support of sustainability, and coupled human-natural systems and behavior.

■ **BU SUSTAINABILITY**

The ISE’s university-wide collaboration with BU Sustainability on campus climate action efforts continued to gain strong momentum this past year, most notably through year-long Campus Climate Lab research to quantify the carbon emissions associated with employee air travel. The College of Arts & Sciences student research team mentored by ISE Executive Director Jacquie Ashmore estimated that employee air travel in 2019 was equal to the carbon footprint of about 967 homes’ energy use for one year, as reported by WBUR EarthWhile. In the post-pandemic era, the report recommended that both offsets and reduction programs play important roles in BU reaching its net-zero emissions goal. For Earth Week, the ISE partnered with Sustainability, BU Student Government, the BUMC Climate Action Group, and the Energy & Sustainability Club to co-host the panel “Exploring Environmental Justice: Energy Justice in the Boston Area.” The ISE’s Jacquie Ashmore and Associate Director Emily Ryan, founder of BU’s Computational Energy Laboratory, were also honored to be spotlighted among BU’s “Sustainability Doers” on the newly relaunched Sustainability website.

STUDENT & ALUMNI EXPERIENCE AT ISE



ISE RESEARCH



Taylor Dudley,
Research Assistant,
ISE (Questrom—Social
Impact, MBA, '21)

Research: [Climate of Crisis, A Survey of North American City Climate Leaders, Accelerating Cities' Net Zero Action: Key Takeaways from Partnership and Innovative Financing Visioning Labs](#), coauthor

“Working with the ISE helped me gain experience with multidisciplinary research teams and showed me how I can add value to research-based teams without having a technical background. My current role as Program Director with All Hands & Hearts in Guatemala gives me a frontline perspective of just how much climate change and natural disasters are impacting vulnerable communities.”

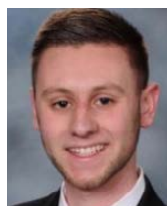


Grant Jones,
Research Assistant,
ISE (Mechanical
Engineering, MS, '22)

Research: [Target—Plan—Finance: A Framework for Climate Policy in Federal Infrastructure Legislation](#)

“Working with the ISE to follow and promote sustainable development efforts has been a great complement to my engineering studies. Though often very different from my course-

work, the research our team conducts allows me to make connections between engineering and politics. Additionally, it has greatly aided my understanding of federal agencies and policies, which has been helpful during my internship this summer with the EPA.”



Ryan Murphy,
Research Assistant,
ISE (Mechanical
Engineering, MS, '22)

Research: Widening the Lens on Innovation for Clean Manufacturing workshop series organizer and report coauthor, [Clean and Competitive: Opportunities for U.S. Manufacturing Leadership in the Global Low-Carbon Economy](#)

“This experience has increased my knowledge of the industrial energy sector greatly, has connected me to a number of key academic, government, and industry leaders, and even helped me get an internship. The thing that stands out most to me is how much respect people have for our project work when they hear that people like Peter Fox-Penner and Henry Kelly are working on it. It gives me confidence that the ISE's work is important nationally and even globally.”



Alicia Zhang,
Graduate Research
Assistant, ISE
(Earth & Environ-
ment, PhD, '25)

Research: [Impact Measurement & Allocation Program](#) research assistant and coauthor, [Climate of Crisis](#) and [A Survey of North American City Climate Leaders](#)

“The IMAP and COVID & Climate projects enhanced my research and investigative skills that are often neglected in a classroom setting while deepening my knowledge of carbon targets and climate action. I enjoy the collaborative experience, which allows me to learn from and engage with the expertise of others. I also appreciate the mentorship and strong guidance not only in my research but also in my career path to becoming a sustainability director in a corporate or government environment.”



Patrick Agri,
Volunteer
Researcher,
ISE (Mechanical
Engineering, BS, '20)

Research: [Response of the Environmental Protection Agency to Public Submissions: Notice and Comment Process in Methane Emission Deregulation](#)

“I was trying to get involved in the sustainability space, give back to the university, and try something new. I am hopeful my technical background will continue to support the efforts ISE looks to study.”

STUDENT RESEARCH



Olivia Henning,
Student Researcher,
Campus Climate Lab
(Environmental
Analysis and Policy,
BA, Energy and
Environment, MA, '22)

Research: [Quantifying Scope 3 Emissions Associated with Employee Travel at Boston University](#), coauthor; *Best Practices for Addressing Employee Air Travel Emissions in Higher Education*, coauthor

“This research has allowed me to pursue my passion for sustainable transportation and aid BU in reaching its own goals set forth by its Climate Action Plan. I was able to refine my data analysis skills, strengthen my interests in sustainability, and see how our work translates into real progress at the university.”



Lucía Vilallonga,
Student Researcher,
Campus Climate Lab
(Statistics & Computer Science, BA, '22)

Research: [Quantifying Scope 3 Emissions Associated with Employee Travel at Boston University](#), coauthor; *Best Practices for Addressing Employee Air Travel Emissions in Higher Education*, coauthor

“This was my first research experience as an undergraduate student at BU, and it has reinforced my interest in pursuing future research in academia, especially in the areas of climate and data.”



John Loftus,
Student Researcher,
Born Global Foundation
Competition for
Innovation in Sustainability
(Mechanical Engineering, BS, '21)

Research: [Fog Harvesting for Sustainable Water Management in Low-Resource Communities](#), coauthor (first-place prize)

“Participating in this project was an exciting way to end my time as a BU student, and it sent me off into my professional career on a high note. Meeting with experts, developing biomimetic designs, and estimating feasibility and impact made working with the ISE on our project for the Born Global Foundation Competition for Innovation in Sustainability a one-of-a-kind experience.”



Kairav Maniar,
Student Researcher,
Born Global Foundation
Competition for
Innovation in Sustainability
(Biomedical Engineering, BS, '21)

Research: [Fog Harvesting for Sustainable Water Management in Low-Resource Communities](#), coauthor (first-place prize)

“This project gave me tangible experience working with biomimicry to address real sustainability problems facing communities around the world. These skills have translated almost directly into my current role and have assisted greatly in the transition from academia to industry to continue to solve the pressing issues of our time. Through the mentorship of Dr. Ashmore, we were able to proceed

fruitfully through the engineering design process. Her varied expertise in sustainable water management and mechanical engineering taught us how to better approach research and design, and how to address sustainability issues from a holistic and constructive perspective.”



Jessica Schueler,
Student Researcher,
Born Global Foundation
Competition for
Innovation in Sustainability
(Sargent College Health
Science and Behavior
& Health, BS, '21)

Research: [Fog Harvesting for Sustainable Water Management in Low-Resource Communities](#), coauthor (first-place prize)

“This project was an interesting way for me to apply my public health knowledge. We focused on the fifth United Nations Sustainable Development Goal to find a sustainable solution to clean water in low-resource settings.”

FACULTY ENGAGEMENT VIGNETTES



Faculty and staff at the BU Sustainability Curriculum Workshop on January 24, 2020. Pictured (left to right): Katharine Lusk of Initiative on Cities and ISE-affiliated faculty Madhu Dutta-Koehler and Dennis Carlberg.

Ayse Coskun, Professor, Department of Electrical and Computer Engineering

Professor Ayse Coskun, together with Professor Yannis Paschalidis (College of Engineering) and ISE-affiliated faculty Richard Stuebi (Questrom), formed a research team to explore the promise of data centers in providing demand response in electricity grids across several different geographies and grid infrastructures. This 18-month project is funded through a Hariri Institute Research Incubation Award, and the research collaboration opportunity was identified during internal knowledge transfer talks focused on the intersection of data sciences and sustainability arranged by the Hariri Institute and the ISE in 2021. Opportunities for follow-on funding from external sources will be explored.

Katharine Lusk, Co-Director and Founding Executive Director of the BU Initiative on Cities

ISE continued its close partnership with the Initiative on Cities, in particular through a research collaboration with its Co-Director Katharine Lusk and Innovation Network for Communities on a series of three reports designed to provide community leaders (inside and outside of local government) with guidance about navigating their climate-

action priorities through the gauntlet of challenges created by the COVID-19 pandemic and the ensuing economic crisis. The research addressed key questions about the opportunities and risks for local climate action and assessed purposeful city actions that can benefit socially vulnerable populations who have experienced disproportionate harm from COVID-19 and climate change.

Kenneth P. Pucker, ISE-Affiliated Faculty, Lecturer on Organizational Behavior, Questrom School of Business

The BU Impact Measurement & Allocation Program's (IMAP's) early progress within the BU community is thanks to numerous program champions, including IMAP- and ISE-affiliated faculty Kenneth Pucker. He has been a strong advocate for the IMAP and frequent collaborator with the work of several Questrom faculty and other academic ESG researchers, notably IMAP-affiliated faculty Andrew King, Professor, Questrom School of Business. Pucker has also shared industry insights as the founding member of the Berkshire Partners Responsible Investment Committee and former COO of Timberland. His thought leadership articles on the social and environmental outcomes of ESG investing have appeared in numerous publications, most recently including "Overselling Sustainability Reporting" in the *Harvard Business Review*.



CROSS-SECTOR COLLABORATIONS

■ BOSTON GREEN RIBBON COMMISSION

The ISE has been an active participant in the Green Ribbon Commission's Higher Education Working Group along with representatives of other Boston-area higher education institutions. The group's goal is to facilitate collaborative research that leverages the higher education sector's capabilities to promote solutions for equitable climate resilience and mitigation in the greater Boston area. The working group has supported the Green Ribbon Commission by convening thought leaders for virtual events throughout the year to disseminate knowledge relevant to climate change mitigation in Boston. The events included a three-part series on building an equitable, healthy, climate-resilient future for Boston, with sessions devoted to the past, present, and future aspects of this.

■ BRITISH GOVERNMENT

An ISE team worked with the British Consulate General Boston, the UK Science and Innovation Network, and other representatives of the UK Government to support U.S. and UK city signatories for the United Nations Framework Convention on Climate Change "Race to Zero," signaling their commitment to achieving zero emissions, ahead of COP26 in Glasgow in November 2021. Other project partners included the UN Climate Change Conference UK 2021, C40 Cities, Metrolab Network, and the Place-Based Climate Action Network. During the project, eight of the cities involved increased their commitment to reducing greenhouse gas emissions.

■ CAMDEN COMMUNITY COLLEGE

The ISE is working to help the Camden, NJ, community college establish a curriculum in clean energy courses for its students. The first stage of the effort is an attempt to establish a laboratory and certification program for advanced "smart" building technicians, a profession that is experiencing high demand. This stage is being led by Gregory King, CEO of TSK Energy, who established a highly successful similar program at Roxbury Community College in Boston, MA. After this course is established, there are plans to expand the curriculum to include other courses such as clean energy entrepreneurship.

■ CITY OF BOSTON

ISE Executive Director Jacquie Ashmore and Carl Spector, City of Boston Environment Commissioner, represented Boston University's work with the City of Boston by speaking at four events with national and international audiences: "Collaborations for Climate Resilience" arranged by the Consortium for Climate Risk in the Urban Northeast, "University-City Collaboration Models for Climate Neutrality" organized by Universidad Politécnica de Madrid, "Net Zero Cities Visioning Lab: Innovative Partnerships" co-hosted by the ISE and UK Government, and "University Networking and Climate Action in North America" in a session on Civic Universities and Sustainability at the UK's Civic University Network Annual Conference.

■ EARTHDAY.ORG & OUTDOOR ADVERTISING ASSOCIATION OF AMERICA (OAAA)

The EARTHDAY.ORG "Restore Our Earth" advertising campaign—which originated in the U.S. last year with subject-matter expert Sarah Finnie Robinson, ISE Senior Fellow and founder of The 51 Percent Project, OAAA, Extra Credit Projects, and Adams Outdoor Advertising—expanded its reach across Africa for Earth Day 2021. The digital campaign also ran coast-to-coast on multiple screens in the U.S., including bulletins, posters, bus shelters, and Times Square signage. On social media, #RestoreOurEarth earned 58.4 million social impressions during April. This year's creative featuring "The Mend Game," "The Beginning of the Mend," and "The Mend of the World" aims to spur conversations and action around regenerating the world's ecosystems.

■ FRAUNHOFER USA CENTER FOR MANUFACTURING INNOVATION (CMI) & INFORMATION TECHNOLOGY & INNOVATION FOUNDATION (ITIF)

In partnership with Fraunhofer CMI at Boston University and the Washington, D.C.-based ITIF, the ISE is studying the potential to create new U.S. manufacturing jobs by investing in new industrial climate technologies. The project brought leading experts in industrial decarbonization together, briefed congressional staff members on Capitol Hill, and issued a report on its Phase I findings. Further research is planned for AY21-22.

COMMUNICATIONS BY THE NUMBERS

10K+

doubled event audience reached

2,341

YouTube video views

112

media hits across ISE
research areas

30%

increase in ISE website visitors

34

new YouTube videos

19

Energy of the Future
series sponsors

14

thought leadership blog posts

ISE BLOG COMMENTARY

[China's Clean Energy Transition Plan Should Have Been More Ambitious and More Aspirational to the World](#),

David Jermain and Justin Ren, Affiliated Faculty

[Four Principles to Reform Federal Policy and Unlock Clean Energy Innovation](#), Dorothy Robyn, Senior Fellow, and David M. Hart, ITIF

[Should Methane Emissions Regulations Be Prescriptive or Performance Based?](#), Robert Kleinberg, Senior Fellow

[Utility Planning Lessons from Texas: Four Recommendations](#), Ira Shavel, Guest Contributor

[The Postal Service's Gas-guzzling New Mail Truck: Electric Versions May Be Closer Than They Appear](#), Dorothy Robyn, Senior Fellow

[Open Letter to Newly Confirmed U.S. Agriculture Secretary](#), Henry Kelly, Senior Fellow

[Black History Month Profiles in Clean Energy Entrepreneurship: Kerry Bowie](#), Laura Hurley, ISE

[Five Questions on Energy & Climate for 2021](#), Sarah Finnie Robinson, Robert Kleinberg, Johannes Pfeifenberger, Senior Fellows, and Emily Ryan, Associate Director

[Insurance Companies and Impact Investing](#), Pauliina Swartz, Senior Fellow

[Vote to Save the World](#), Rick Reibstein, Affiliated Faculty

[How Did the UAE Manage Its Renewable Energy Investments During COVID?](#), Ahmad Ali Azari, MA International Affairs ('21)

[EPA Rescinds Methane Control Regulations. What Does It Mean for Methane Detection Technology?](#), Robert Kleinberg, Senior Fellow

[Flaring of Natural Gas in Guyana: Why Is It Happening, and How Can It Be Minimized?](#), Robert Kleinberg, Senior Fellow

[Perspectives: Sustainability After COVID-19](#), Sarah Finnie Robinson, Senior Fellow



ENERGY OF THE FUTURE SERIES

[Enhancing Social Equity in City Climate Action and Sustainability Planning:](#)

The ISE's report series on COVID-19 and city climate action set the stage to discuss how the pandemic response would create opportunities and risks for local climate action in lockstep with social equity. ISE Executive Director Jacquie Ashmore moderated, with panelists Cutler Cleveland, ISE Associate Director, joining affiliated faculty Jonathan Levy from BU Environmental Health; City of Providence, RI sustainability and environmental justice advocacy experts; and Northeastern University School of Law's Shalanda Baker, who's currently serving as the Deputy Director for Energy Justice at the Department of Energy.

[Clean Energy Markets in the Wake of COVID-19:](#)

At the height of the pandemic, the U.S. energy sector was roiled by a combination of COVID-19 supply chain challenges, demand reductions, and geopolitical tensions between oil-producing countries—sending the price of U.S. crude oil negative. This panel discussed the dynamics that would shape the clean energy markets in 2021 and beyond. Academic researchers from BU, the University of California Berkeley, and Tufts University joined moderator and ISE Director Peter Fox-Penner.

[Integrating Advanced Manufacturing and Climate Change Policies:](#)

The ISE spotlighted opportunities for advancing clean manufacturing innovation in the U.S. to increase its competitiveness. Moderated by ISE-affiliated faculty Andre Sharon

and Executive Director, Fraunhofer USA Center for Manufacturing Innovation (CMI), the panel included experts from the Information Technology & Innovation Foundation (ITIF) and the BlueGreen Alliance with ISE Senior Fellow Henry Kelly.

[Climate Policy under President Biden and the New Congress: A Conversation with Congressman Sean Casten:](#)

Special guest speaker U.S. Representative Sean Casten (D-IL) shared insights from Capitol Hill at a pivotal moment for U.S. climate action, commanding the ISE's largest-ever webinar audience with nearly 500 registrants. Congressman Casten brought the unique perspective of scientist, clean energy entrepreneur, and member of the House Select Committee on the Climate Crisis to the conversation.

[Energy-Water Nexus Transition to Address Climate Change:](#)

The ISE offered a global look at the interlinkages between energy and water demand, recognizing that transition pathways for each resource in isolation do not account for the complex interactions, risks, and opportunities that could be revealed by considering the nexus. ISE Executive Director Jacquie Ashmore joined fellow panelist Gustaf Olsson, Professor Emeritus at Lund University in Sweden, for a conversation moderated by ISE Senior Fellow Lawrence Jones.

[Women Leading the Charge in Energy Storage to Advance Renewable and EV Growth:](#)

Women at the forefront of energy storage technologies in

academia and industry discussed the future of electrochemical energy storage for the expansion of renewable energy and electric vehicles—including technological challenges, promising new directions, and the transition of fundamental research to commercial products. Moderated by ISE Associate Director Emily Ryan, the panel convened experts from Princeton University, University of California Irvine, Ameresco, and Plus Power.

[Sustainable African Electricity Sector Expansion: The Critical Role of Social Factors:](#)

Energy poverty in Africa is pervasive—about 600 million people have no access to electricity service. ISE-affiliated faculty at the Questrom School of Business, Justin Ren and Richard Stuebi, discussed their ongoing research that proposes a system dynamics framework to describe the forces shaping electricity infrastructure expansion in Africa.

[Improving Sustainable Investing through Better ESG Metrics:](#)

The investment industry is increasingly calling for new sources of high-quality environmental, social, and governance (ESG) metrics to evaluate corporate performance. Leading academic researchers from BU and the University of California Los Angeles discussed new metrics under development and potential third-party data sources to fill today's data gaps. Co-hosted by the ISE, Susilo Institute for Ethics in the Global Economy, and the BU Impact Measurement & Allocation Program.

(See [Appendix](#) for all FY21 events)

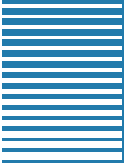
SPONSORS: Advanced Energy Economy | Edison Electric Institute | Energy Storage Association | Fraunhofer USA Center for Manufacturing Innovation | HOMER Energy | Information Technology & Innovation Foundation | National Association of State Energy Officials | Northeast Clean Energy Council | **BOSTON UNIVERSITY:** College of Engineering | Questrom School of Business | Division of Materials Science & Engineering | Earth & Environment | Political Science | African Studies Center | Initiative on Cities | Global Development Policy Center | Frederick S. Pardee Center for the Study of the Longer-Range Future | Energy & Sustainability Club | Cleantech Club



▲ **“So often in politics, we start by saying what’s politically possible. If we don’t start by saying what’s scientifically necessary, we’ve done our grandchildren a disservice.”** — U.S. Representative Sean Casten, ISE Energy of the Future webinar, “Climate Policy under President Biden and the New Congress,” January 29, 2021

▼ **“For many people that are in these [environmental justice] communities, the link between the knee on the neck of a Black person is quite tight when you think about environmental justice and environmental harm. They can’t breathe and they haven’t been able to breathe for decades.”** — Shalanda Baker, Professor of Law, Public Policy and Urban Affairs, Northeastern University School of Law (currently serving as Deputy Director for Energy Justice at the Department of Energy), ISE Energy of the Future webinar, “Enhancing Social Equity in City Climate Action and Sustainability Planning,” September 25, 2020





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Questrom School of
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Co-Director, Impact
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FACULTY ASSOCIATE DIRECTORS



Cutler Cleveland

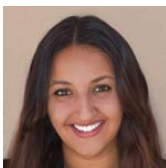
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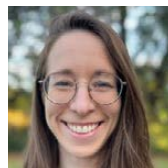
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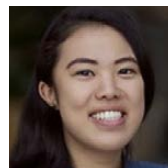
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ADVISORY BOARD

■ LETTER FROM THE BOARD CHAIR

Dear ISE Colleagues:

As we approach the appointment of our second Director of the Institute for Sustainable Energy, it is a good time to reflect upon the accomplishments of our advisory board. It has been very clear from the establishment of the Institute that Boston University is packed with well-accomplished faculty and researchers highly regarded in their respective fields across many diverse areas of study. In that regard, the ISE has proven to be an extremely useful tool to help focus funding and collaboration among BU faculty, enhancing the university's standing globally.

The biggest accomplishment of our board has been the introduction and inclusion of industry-leading representatives to be among our members. This inclusion added a dimension to the ISE that brought important perspectives to the Institute's work as the global goals of sustainability and energy sustainability became universally embraced. With the help of the board, the Institute has remained focused and engaged on highly relevant aspects of sustainable energy. This increasing and supportive role of the private sector is now embedded into our Institute and is something that can be expanded.

—Sheldon Simon, ISE Advisory Board Chair



Jill Anderson

Vice President of Customer Service, Southern California Edison



Nathaniel Dalton

Founder, Daybreak Partners



Sheldon Simon

Partner and Equity Analyst, Adage Capital Management, L.P.



Ned Bartlett

Chief Compliance Officer, Veolia North America



James Goudreau

Head of Climate, Novartis



John S. Skrinar

Director of Sustainable Investments, Cresta Fund Management



Stephen Byrd

Head of North American Equity Research, Power/Utilities and Clean Tech, Morgan Stanley



Penni McLean-Conner

Chief Customer Officer and Senior Vice President of Customer Group, Eversource Energy

SENIOR FELLOWS



Eugene J. Berardi
Visiting Senior
Fellow & Researcher,
ISE



Ed Craig
Founder & Executive
Director, ECCI



**Sarah Finnie
Robinson**
Founding Director,
The 51 Percent
Project



**Lawrence
Goldenhersh**
President, Center for
Sustainable Energy



David Jermain
Owner, DOJc
Consulting



Lawrence E. Jones
Vice President,
International
Programs, Edison
Electric Institute



Henry Kelly
Senior Fellow



Robert Kleinberg
Principal, Presidio
Energy Technology



**Rebecca
Pearl-Martinez**
Doctoral Researcher,
Dept. of Geography
at Durham University



Olena Pechak
Senior Fellow



Brett Perlman
CEO, Center for
Houston's Future



**Johannes
Pfeifenberger**
Principal, The
Brattle Group



Dorothy Robyn
Senior Fellow



Kurt Roth
Head, Building
Energy Systems,
Fraunhofer USA



Jonathan Schrag
Principal, Taconic
Advisory Services LLC



Pauliina Swartz, CFA
Principal, Banking on
Green LLC



Philip Warburg
Author and Lawyer



Karen Wayland
CEO, GridWise Alliance



Yingxia Yang
Director of Commercial
Strategy, BrightNight

AFFILIATED FACULTY



COLLEGE OF ARTS AND SCIENCES

Stan Sclaroff, Dean, College of Arts & Sciences
Pamela Templer, Prof., Biology (Grad)
Sean Elliott, Prof., Chemistry
Malika Jeffries-EL, Assoc. Dean, Graduate School of Arts & Sciences, Assoc. Prof., Chemistry
Bruce Anderson, Prof., Assoc. Chair of Faculty Actions, Earth & Environment
Dennis Carlberg, Assoc. Vice President, University Sustainability, Adjunct Asst. Prof., Earth & Environment
***Cutler Cleveland**, Prof., Earth & Environment
Sucharita Gopal, Prof., Earth & Environment
Lucy Hutyra, Prof., Earth & Environment
Robert K. Kaufmann, Prof., Earth & Environment
Nathan Phillips, Prof., Earth & Environment
Rick Reibstein, Lecturer, Earth & Environment
Ian Sue Wing, Prof., Earth & Environment
Laurence Kotlikoff, Prof., Economics
Marc Rysman, Prof., Dept. Chair, Economics
Tarek Hassan, Assoc. Prof., Economics

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Kenneth R. Lutchen, Dean, College of Engineering
Soumendra Basu, Prof., Mechanical Engineering
Greg Blonder, Prof. of the Practice, Mechanical Engineering
Panagiotis Andrianesis, Research Assoc. Prof., Systems Engineering
Michael Caramanis, Prof., Mechanical Engineering & Systems Engineering
Christos Cassandras, Distinguished Prof., Head of Division of Systems Engineering, Electrical Computer Engineering & Systems Engineering
Thomas Little, Prof., Electrical & Computer Engineering, Assoc. Dean of Educational Initiatives, Assoc. Director, NSF Smart Lighting Engineering Research Center
Malay Mazumder, Research Prof., Electrical & Computer Engineering
Michael Gevelber, Assoc. Prof., Mechanical Engineering
Srikanth Gopalan, Assoc. Prof., Mechanical Engineering
J. Gregory McDaniel, Assoc. Prof., Mechanical Engineering
Uday Pal, Prof., Mechanical Engineering

Pablo A. Ruiz, Research Assoc. Prof., Mechanical Engineering
***Emily Ryan**, Assoc. Prof., Mechanical Engineering
Andre Sharon, Prof., Mechanical Engineering

QUESTROM SCHOOL OF BUSINESS

Susan Fournier, Dean, Questrom School of Business
Nalin Kulatilaka, Prof., Management & Finance, Co-Director, Impact Measurement & Allocation Program
Marshall Van Alstyne, Prof., Management, Chair of Information Systems Dept.
Robert Metcalfe, Asst. Prof., Markets, Public Policy & Law
James Rebitzer, Prof., Markets, Public Policy & Law, Chair of Questrom School of Business
Arzum Akkas, Asst. Prof., Operations & Technology Management
J. Robb Dixon, Assoc. Prof., Operations & Technology Management
Nitin Joglekar, Assoc. Prof., Operations & Technology Management
Z. Justin Ren, Assoc. Prof., Operations & Technology Management
Kenneth Pucker, Lecturer, Organizational Behavior
Philip Hanser, Lecturer, Markets, Public Policy & Law
Paul Cosway, Lecturer, Strategy & Innovation
Caroline Flammer, Assoc. Prof., Strategy & Innovation
Paul McManus, Master Lecturer, Strategy & Innovation
Richard Stuebi, Lecturer, Strategy & Innovation
Jeffrey P. Davis, Lecturer, Entrepreneurial Finance
James Koehler, Lecturer, Markets, Public Policy & Law

COLLEGE OF COMMUNICATION

***Sarah Finnie Robinson**, Adjunct Clinical Prof.

FREDERICK S. PARDEE SCHOOL OF GLOBAL STUDIES

Kevin Gallagher, Prof., Director, Global Development Policy Center
Henrik Selin, Assoc. Dean for Studies, Assoc. Prof. of International Relations

METROPOLITAN COLLEGE

Madhu Dutta-Koehler, Assoc. Prof. of the Professional Practice, Director, City Planning & Urban Affairs
Stephen A. Leybourne, Asst. Prof., Administrative Sciences, Director for Student Admission

SCHOOL OF LAW

Michael Baram, Prof. of Law, Health Law
Alan Feld, Prof. of Law

SCHOOL OF PUBLIC HEALTH

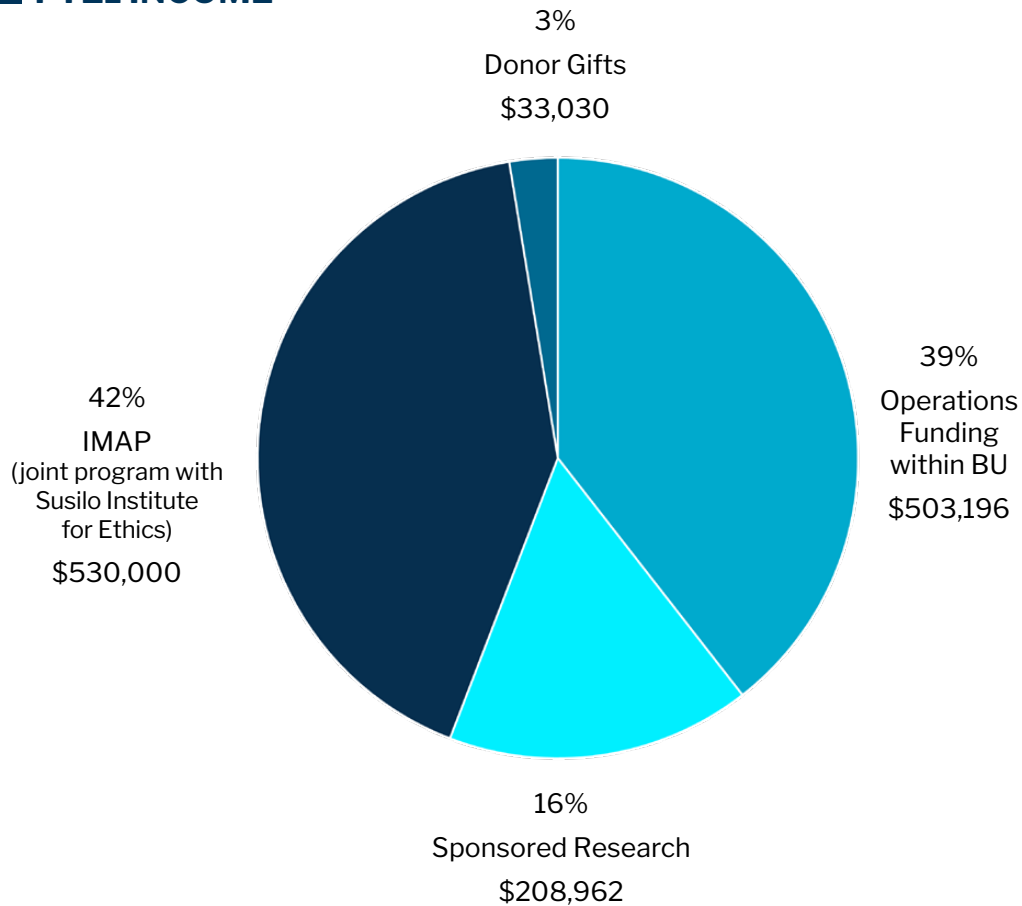
Wendy Heiger-Bernays, Clinical Prof., Environmental Health
Patrick L. Kinney, Prof., Environmental Health, Kinney Lab
Jonathan I. Levy, Prof., Environmental Health

IMPACT MEASUREMENT & ALLOCATION PROGRAM

Nalin Kulatilaka, Prof., Management & Finance, Co-Director, Impact Measurement & Allocation Program
Madison Condon, Assoc. Prof. of Law, School of Law
Caroline Flammer, Assoc. Prof., Strategy & Innovation, Fellow of the Susilo Institute
Kimberly Gladman, Lecturer, Finance, Questrom School of Business
Sucharita Gopal, Prof., Earth & Environment
Andrew King, Prof., Management, Prof., Strategy & Innovation, Questrom School of Business
James Koehler, Lecturer, Markets, Public Policy & Law, Questrom School of Business
Nina Mažar, Prof., Marketing, Questrom School of Business, Co-Director of Susilo Institute for Ethics in the Global Economy
Kenneth P. Pucker, Lecturer, Organizational Behavior, Questrom School of Business
Estelle Sun, Dean's Research Scholar, Asst. Prof., Accounting, Questrom School of Business

** Core ISE faculty. Core faculty participate in the day-to-day activities of the ISE by being a lead for or a member of a research team on a project for which the funding runs through the ISE. Affiliated faculty engage by participating in ISE research discussions and events throughout the academic year.*

■ FY21 INCOME



SPONSORED RESEARCH

Source	Duration	Amount
British Consulate	1/1/21-5/25/21	\$21,500
Hewlett	7/1/20-10/01/20	\$35,267
Innovation Network for Communities	7/1/20-10/31/20	\$43,767
Breakthrough Energy	1/1/21-7/31/21	\$108,428
TOTAL SPONSORED FUNDING		\$208,962

APPENDIX: EVENTS & SPEAKING ENGAGEMENTS

Focus: SC = Sustainable Cities, ES = Energy Systems of the Future, CC = Climate Communication, SW = Sustainable Water Management, SF = Sustainable Finance

Date	Event	ISE Speakers/ Moderator	Sponsor/Host	Focus
7/10/20	EBC Climate Change Leadership Webinar Series: Carbon Free Boston—A Long-Term Framework	Cutler Cleveland	Environmental Business Council of New England (EBC)	SC
7/16/20	NRRI Author Spotlight: Dr. Peter Fox-Penner, <i>Power after Carbon</i>	Peter Fox-Penner	National Regulatory Research Institute (NRRI)	ES
7/28/20	GRCx: Green Ribbon Commission Climate Action Exchange Urban Geothermal to Electrify Heating and Cooling	Dennis Carlberg	Green Ribbon Commission Higher Ed Working Group/ISE	ES
7/29/20	Enhancing Federal Clean Energy Innovation	Dorothy Robyn	National Academy of Sciences	ES
7/29/20	<i>Power after Carbon</i> : Transitioning to Low-Carbon Power in the United States	Peter Fox-Penner	Center on Global Energy Policy	ES
8/3/20	U.S. Climate Action in the Era of COVID	Jacque Ashmore	We Are America the Beautiful	ES
8/11/20	Summer Energy Talks: COVID-19's Impact on Energy and Environment Perceptions	Peter Fox-Penner	University of Texas at Austin Energy Institute	ES
8/19/20	Harvard Advanced Leadership Initiative	Peter Fox-Penner	Harvard Advanced Leadership Initiative	ES
8/25/20	Climate Champions Podcast	Peter Fox-Penner	Krevat Energy Innovations	ES
9/9/20	Greentown Labs and Schneider Electric Bold Ideas Challenge 2020 Kickoff	N/A	Greentown Labs	ES
9/9/20	<i>Power after Carbon</i> : Findings and Insights for State Policymakers	Peter Fox-Penner	Clean Energy States Alliance	ES
9/10/20	Energy Storage Policies for a Zero-Carbon Grid	Peter Fox-Penner	Center on Global Energy Policy at Columbia University, Energy Foundation-China	ES
9/14/20	WEI Annual Meeting	Peter Fox-Penner	Western Energy Institute (WEI)	ES
9/16/20	BU Energy & Sustainability Club Kickoff Event	Jacque Ashmore	Energy & Sustainability Club	ES
9/25/20	Climate Adaptation Forum: Psychology, Semantics, and Strategy: Accelerating Response to Climate Change	Sarah Finnie Robinson	Environmental Business Council of New England, Sustainable Solutions Lab at the University of Massachusetts Boston	CC

Events & Speaking Engagements *continued*

9/25/20	Energy of the Future Enhancing Social Equity in City Climate Action and Sustainability Planning	Jaquie Ashmore, Cutler Cleveland, Jon Levy	ISE, Northeast Clean Energy Council, Initiative on Cities	SC
10/5/20	Decarbonizing Power Markets: Climate Change Comes for California	Johannes Pfeifenberger	MIT Energy Initiative	ES
10/14/20	Renewable Generation Diversity Benefits of Transmission	Johannes Pfeifenberger, Pablo Ruiz	ISE	ES
10/15/20	Climate of Crisis: How Cities Can Use Climate Action to Close the Equity Gap, Drive Economic Recovery, and Improve Public Health	Cutler Cleveland	American Planning Association Sustainable Communities Division	SC
10/20/20	EPRG Energy & Environment Seminar: <i>Power after Carbon</i>	Peter Fox-Penner	University of Cambridge Energy Policy Research Group	ES
10/21/20	Climate Roundtable with the UK and the City of Glasgow in Advance of COP26	Jacquie Ashmore	MetroLab Network	ES
10/21/20	WCEE Book Club Author Spotlight: <i>Power after Carbon: Building a Clean, Resilient Grid</i>	Peter Fox-Penner	Women's Council on Energy and the Environment	ES
10/23/20	Energy of the Future Clean Energy Markets in the Wake of COVID-19	Peter Fox-Penner, Robert Kaufmann	ISE, Northeast Clean Energy Council, Earth & Environment, Pardee Center, Energy & Sustainability Club	ES
10/30/20	How Democracy Survives: The Crises of the Nation State: Democracy and the Global Commons	Cutler Cleveland	Pardee Center	Other
11/5/20	Negative Emissions Science	Emily Ryan	Scialog, Alfred P. Sloan Foundation, Research Corporation for Science Advancement	ES
11/11/20	How Will China Achieve Its New Climate Change Goals?	Yingxia Yang	Duke Nicholas Institute for Environmental Policy Solutions, Duke Kunshan Environmental Research Center	ES
11/13/20	How COVID-19 Has Impacted Different Areas in Society: Climate Change and Social Equity	Cutler Cleveland	Berklee College of Music	SC
11/18/20	2020 MGA and OMS Transmission Summit: Keynote on Big Grid vs. Little Grid	Peter Fox-Penner	Organization of MISO States (OMS), Midwest Governor's Association (MGA)	ES
11/19/20	Solved: How the World's Great Cities are Fixing the Climate Crisis with Author David Miller	N/A	Initiative on Cities, ISE	SC
11/20/20	Energy of the Future Integrating Advanced Manufacturing and Climate Change Policies	Andre Sharon, Henry Kelly	ISE, Northeast Clean Energy Council, Information Technology & Innovation Foundation, Fraunhofer USA Center for Manufacturing Innovation, Energy & Sustainability Club, Cleantech Club	ES
12/1/20	Enhancing Federal Clean Energy Innovation: Looking Forward	Dorothy Robyn	The National Academies	ES
12/1/20	EPRI Utility Business Model Workshop	Peter Fox-Penner	Electric Power Research Institute, Gridwise Alliance, Grid Forward, Smart Electric Power Alliance	ES
12/1/20	New University-City Collaboration Models for Climate Neutrality: ISE/City of Boston collaboration	Jacquie Ashmore	Technical University of Madrid	SC

Events & Speaking Engagements *continued*

12/2/20	Municipal Voices: On the Frontlines of Climate Resilience and Justice	Jacque Ashmore	Greentown Labs	SC
12/3/20	National Commissioners Forum: How to Align Utility Finances	Peter Fox-Penner	National Association of Regulatory Utilities Commissioners	ES
12/9/20	MassCEC CEO & Investor Summit	Peter Fox-Penner	Massachusetts Clean Energy Center	ES
12/10/20	GridCONNEXT Virtual 2020	Peter Fox-Penner	Gridwise Alliance	ES
12/16/20	Market Designs for the Clean Energy Transition: Advancing Long-Term Approaches	Peter Fox-Penner	World Resources Institute, Resources for the Future	ES
1/4/21	Flaring and Methane Emissions in Oil and Gas: Global Warming Potential of Flaring and Methane Emissions	Robert Kleinberg	American Economic Association, International Association for Energy Economics	ES
1/13/21	North Shore Technology Council's Sustainability Forum Webinar: Covid & Climate: What is Next for Cities?	Jacque Ashmore	North Shore Technology Council	SC
1/27/21	NERC Reliability Summit	Peter Fox-Penner	North American Electric Reliability Corporation	ES
1/27/21	Transmission Time – Planning for the Future: FERC's Opportunity to Spur More Cost-Effective Transmission Infrastructure	Peter Fox-Penner	Americans for a Clean Energy Grid	ES
1/27/21	Widening the Lens on Innovation for Clean Manufacturing Greening High-Temperature Manufacturing: Toward an RD&D Agenda	Dorothy Robyn	ISE, Information Technology & Innovation Foundation, Fraunhofer USA Center for Manufacturing Innovation	ES
1/29/21	Energy of the Future Climate Policy under President Biden and the New Congress: A Conversation with Congressman Sean Casten	Peter Fox-Penner, Jacque Ashmore	ISE, Northeast Clean Energy Council, Advanced Energy Economy, National Association of State Energy Officials, Energy and Sustainability Club, Pardue Center, Dept. of Political Science	ES
2/1/21	ENRP / HUCE / MRCBG Energy Policy Seminar Series: <i>Power after Carbon</i>	Peter Fox-Penner	Harvard Kennedy School Belfer Center for Science & International Affairs, Environment and Natural Resources Program (ENRP), Harvard University Center for the Environment (HUCE), Mossavar-Rahmani Center for Business and Government (M-RCBG)	ES
2/3/21	Widening the Lens on Innovation for Clean Manufacturing: Low-Temperature Industrial Processes	N/A	ISE, Information Technology & Innovation Foundation, Fraunhofer USA Center for Manufacturing Innovation	ES
2/3/21	New Source Performance Standards for the Oil and Natural Gas Industry Obama vs Trump vs Biden: What Needs to Be Fixed and What Should Be Left Alone	Robert Kleinberg	Center on Global Energy Policy, Columbia University	ES
2/10/21	Energy Leaders Webinar Series: Guiding Principles for Sound Energy Policy	Peter Fox-Penner	OurEnergyPolicy.Org	ES
2/10/21	Widening the Lens on Innovation for Clean Manufacturing Bio-Manufacturing: Opportunities to Contribute to Climate Change Mitigation	N/A	ISE, Information Technology & Innovation Foundation, Fraunhofer USA Center for Manufacturing Innovation	ES

Events & Speaking Engagements *continued*

2/12/21	BU Knowledge Transfer: Sharing Research at the Interface of Data Sciences and Sustainability Series (Smart Cities and Sustainability)	Christo Cassandras, Thomas Little	ISE, Hariri Institute for Computing	SC
2/17/21	Widening the Lens on Innovation for Clean Manufacturing: Alternative Materials	N/A	ISE, Information Technology & Innovation Foundation, Fraunhofer USA Center for Manufacturing Innovation	ES
2/17/21	Net Zero Cities Visioning Lab: Innovative Partnerships	Jacque Ashmore, ISE Executive Director	ISE, British Foreign Commonwealth and Development Office	SC
2/18/21	Net Zero Cities Visioning Lab: Financing Methods	Jacque Ashmore, ISE Executive Director	ISE, British Foreign Commonwealth and Development Office	SC
2/19/21	Energy of the Future Energy-Water Nexus Transition to Address Climate Change	Jacque Ashmore, Lawrence Jones	ISE, Northeast Clean Energy Council, Edison Electric Institute, Energy and Sustainability Club	SW
2/25/21	Climate Change and the Prospects for the Rapid Decarbonization of Energy Supplies	Peter Fox-Penner, Cutler Cleveland	Boston University Board of Trustees Advisory Committee on Socially Responsible Investing	ES
3/4/21	BU GWISE Careers In Sustainability Panel Discussion	Emily Ryan	BU Graduate Women in Science and Engineering (GWISE)	ES
3/8/21	BU Knowledge Transfer: Sharing Research at the Interface of Data Sciences and Sustainability Series Computing and Technology in Support of Sustainability	N/A	ISE, Hariri Institute for Computing	ES
3/10/21	Energy Efficiency: Innovations That Drive Prosperity and Slash Emissions	Henry Kelly	ISE	ES
3/17/21	Workshop on a Regulatory Approach on Venting and Flaring of Methane in the Oil and Gas Sectors	Robert Kleinberg	European Commission	ES
3/19/21	Setting Justification for Renewables and Smart Power	Peter Fox-Penner	Energy Law Institute at Queen Mary University of London	ES
3/24/21	2021 Industrial Policy Series: Green Industrial Policy	Henry Kelly	Industry Studies Association	ES
3/26/21	Energy of the Future Women Leading the Charge in Energy Storage to Advance Renewable and EV Growth	Emily Ryan	ISE, Northeast Clean Energy Council, Energy Storage Association, College of Engineering, Division of Materials Science & Engineering, Energy & Sustainability Club	ES
3/30/21	Talking to Your Children About Climate Change	Jacque Ashmore	The Boston Globe	CC
3/30/21	Replay and Live Discussion: Tackling Climate Change: Mitigation or Adaptation?	Jacque Ashmore, Patrick Kinney	BU School of Public Health	ES
3/31/21	BU Knowledge Transfer Series: Coupled Human-Natural Systems and Behavior	Sucharita Gopal, Cutler Cleveland	ISE, Hariri Institute for Computing	SC
4/14/21	Energy Policy Washington Briefing	Peter Fox-Penner	BU Federal Relations	ES
4/21/21	How We Talk About the Climate Crisis	Sarah Finnie Robinson	BU College of Communication	CC

Events & Speaking Engagements *continued*

4/21/21	Exploring Environmental Justice: Energy Justice in the Boston Area	N/A	BU Sustainability, ISE	SC
4/23/21	Energy of the Future Sustainable African Electricity Sector Expansion: The Critical Role of Social Factors	Richard Stuebi, Justin Ren	ISE, Northeast Clean Energy Council, HOMER Energy, African Studies Center, Global Development Policy Center, Questrom School of Business, Energy and Sustainability Club	ES
4/26/21	SMG Are We Here Yet Podcast	Jacque Ashmore	SM Graves Associates (SMG)	ES
4/29/21	American Climate Leadership Summit 2021 Climate + You Forum: Food, Family, Wellness	Sarah Finnie Robinson	American Climate Leadership Summit	CC
4/30/21	Harvard Planetary Health Alliance annual meeting Activating the Mainstream: Our Urgent Planetary Health Mission to Protect the Future	Sarah Finnie Robinson	Harvard Planetary Health Alliance	CC
5/6/21	The Role of Gamification in the Public Sector: 'Level Zero: Solving Climate Problems with Gamification'	Sarah Finnie Robinson	Public, Play Consulting	CC
5/6/21	2nd Annual Hydrogen Markets Americas Virtual Conference: Regional Initiatives to Support the Growth of Hydrogen	Brett Perlman	S&P Global Platts	ES
5/18/21	The Civic Movement: Universities Working in Partnership Conference 2021: City of Boston's and Boston University's partnership on climate action	Jacque Ashmore	Civic University Network	SC
5/27/21	NEECE 2021: Energy of the Moment State PUCs Climate & New Technology: It Isn't Easy Being Green	Jacque Ashmore	Northeast Energy and Commerce Association	ES
6/8/21	Decarbonizing the Grid	Peter Fox-Penner, Karen Wayland	Grid Forward	ES
6/17/21	Energy of the Future Improving Sustainable Investing through Better ESG Metrics	Susan Fredholm Murphy, Sucharita Gopal, Nina Mažar	ISE, Susilo Institute for Ethics in the Global Economy, Impact Measurement & Allocation Program, Northeast Clean Energy Council, Questrom School of Business	SF
6/24/21	How to Make US Manufacturing Clean and Competitive in a Global Low-Carbon Economy	Peter Fox-Penner	ISE, Information Technology & Innovation Foundation, Fraunhofer USA Center for Manufacturing Innovation	ES
6/29/21	The Future of Global Energy: Houston's Role in Leading the Energy Transition	Brett Perlman	Center for Houston's Future	ES

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Snapshots from home and the office—our new “normal” during the pandemic.

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