

MIT ENERGY INITIATIVE Impact Report

2018-2019



MITei
MIT Energy Initiative

MIT Energy Initiative, 2018-2019

Over the past year, the MIT Energy Initiative (MITEI) has continued to work toward realizing a decarbonized future by developing clean energy technologies and solutions; educating the next generation of change makers; and connecting academia, industry, and government.

MITEI's research portfolio remains diverse, including research and analysis on deep decarbonization of four major energy sectors: power, transportation, industry, and building. Fusion has become the largest single area of research funded through MITEI—followed closely by solar—and in June, MITEI hosted a well-received symposium to investigate the role of hydrogen as part of a low-carbon future.

This academic year, MIT is hosting a series of six Climate Action symposia to examine the serious challenge of climate change. MITEI is working with MIT's Office of the Vice President for Research and symposium organizers to produce the series, which draws on the objectives of MIT's Plan for Action on Climate Change.

Additionally, we published our revised Energy Studies Minor curriculum this summer after receiving acceptance from the Committee on Curricula. It will lead to improved curriculum flexibility across the fall and spring course offerings and an increase in the number of advisors across academic departments.

We deeply appreciate your generous support for our programs as we grow and expand our efforts to accelerate the transition to low- and no-carbon global energy systems. This report reflects the profound impact that you have made, and we look forward to sharing our work with you over the coming year. Thank you again for your generosity.

With gratitude,



Robert C. Armstrong
Director, MIT Energy Initiative
Chevron Professor of Chemical Engineering

Research



Professor Stuart Madnick (left), graduate student Shaharyar Khan (right), and Professor James Kirtley Jr. (not pictured) used their “cybersafety” methodology to identify several cyber vulnerabilities in a small power plant. *Photo: Stuart Darsch*



The Mobility Systems Center, one of MITEI's Low-Carbon Energy Centers, launched this fall to help guide sustainable and efficient global mobility growth by developing, maintaining, and applying state-of-the-art tools for mobility research.



Graduate student Aliza Khurram prepares for experiments by pumping carbon dioxide through an electrochemical cell consisting of lithium and carbon electrodes plus a specially designed electrolyte. *Photo: Stuart Darsch*

Research

MITEI's research portfolio reflects the Initiative's goal of advancing low-carbon energy via diverse channels, from renewable energy and energy efficiency to carbon management technologies. An important component of the portfolio includes research and analysis on the energy systems—power, transportation, industry, and building—into which new technologies need to fit to provide needed energy services to society. The largest single area of research funding at MITEI over the past year was fusion, reflecting the intense effort now underway to develop sufficiently strong magnets to enable net power with the new SPARC fusion reactor concept. Fusion was followed closely by solar and a broad array of other science, technology, and policy programs. Recognizing the long time horizons involved in energy transition, MITEI also includes projects geared toward meeting contemporary energy needs through more efficient and environmentally responsible use of conventional energy systems.

MITEI members have sponsored over 900 projects to date, many involving collaborations between MIT researchers and member researchers. Approximately 30 percent of MIT faculty has engaged with MITEI's programs.

MITEI Research Highlights

Low-Carbon Energy Centers: MITEI continues to develop and evolve its program of Low-Carbon Energy Centers, which launched in the fall of 2015 as part of MIT's [Plan for Action on Climate Change](#). These research centers are dedicated to tackling the most pressing energy challenges related to climate change from key technological and economic perspectives. Each of the centers has a distinct focus: advanced nuclear energy systems; carbon capture, utilization, and storage; electric power systems; energy bioscience; energy storage; materials for energy and extreme environments; mobility systems (newly launched); and solar energy. Fusion research is conducted in collaboration with the MIT [Laboratory for Innovation in Fusion Technologies \(LIFT\)](#).

To solve the pressing challenges of decarbonizing the energy sector with advanced technologies, it is vital that experts across all disciplines and sectors are engaged. Through the Low-Carbon Energy Centers, MITEI facilitates this important collaboration: enabling faculty members from across MIT to converge around specific technology research areas and work with industry and

government members to advance and expand the portfolio of existing MITEI-facilitated research in these areas. Together, MIT researchers and center members are working to develop and scale the technologies that will move us toward a low-carbon energy future.

Based on sustained member interest in addressing issues such as those raised in the [Mobility of the Future](#) study, MITEI launched the [Mobility Systems Center](#) as a new Low-Carbon Energy Center. The Center expands the scope of MITEI's mobility research to include unique challenges facing mobility in high-growth developing countries, clean propulsion, long haul freight, and urban freight, in addition to a continued focus on disruptive technologies for passenger transport.

Funding for early-stage research: One of MITEI's core tenets is supporting promising energy research across a wide range of disciplines. MITEI awarded seed grants to seven early-stage research projects this spring for a total of approximately \$1 million. Including 2019, MITEI has supported 177 energy-focused seed projects with grants totaling approximately \$23.6 million. These projects have covered the full spectrum of energy research areas, from fundamental physics and chemistry to policy and economics, and have drawn from all five MIT schools and 28 departments, labs, and centers.

Studies and reports: *Insights into Future Mobility*, the report from the [Mobility of the Future](#) study team, led by faculty chair William H. Green, professor of chemical engineering, and Randall Field of MITEI, executive director of the study, was presented in Washington, D.C., in November 2019. This study explores how consumers and markets will respond to potentially disruptive technologies, business models, and government policies in the transportation sector, with a focus on the uptake of alternative fuel vehicles for passenger travel.

Another MITEI study, the Future of Energy Storage, is now underway with a report anticipated in 2021, and will focus on the role of storage in

making electricity systems cleaner and more efficient. The study considers storage technologies; the economics of storage; practical system transformation pathways for industry; and possible government roles in market design and regulation, research, and deployment support for storage in the 2020 to 2040 timeframe.

In fall 2018, a team of researchers led by MIT Department of Nuclear Science and Engineering TEPCO Professor Jacopo Buongiorno completed the multidisciplinary study [The Future of Nuclear Energy in a Carbon-Constrained World](#), the eighth in MITEI's "Future of" study series. The study, which was released in September 2018 with events in the United States, Europe, and Asia, provides an objective assessment of the opportunities and challenges affecting the ability of nuclear energy technologies to meet U.S. and global energy needs in the context of the imperative to dramatically reduce carbon emissions in order to address climate change.

Faculty Research Highlights

MATERIALS SCIENCE

[Shrinking the carbon footprint of a chemical in everyday objects](#)

The biggest source of global energy consumption is the industrial manufacturing of products such as plastics, iron, and steel. Not only does manufacturing these materials require huge amounts of energy, but many of the reactions also directly emit carbon dioxide as a byproduct. In an effort to help reduce this energy use and the related emissions, Professor Karthish Manthiram and other MIT chemical engineers have devised an alternative approach to synthesizing epoxides, a type of chemical that is used to manufacture diverse products, including plastics, pharmaceuticals, and textiles. Their new approach, which uses electricity to run the reaction, can be done at room temperature and atmospheric

pressure while eliminating carbon dioxide as a byproduct.

ENERGY STORAGE

[New approach could boost energy capacity of lithium batteries](#)

Professor Ju Li and postdoc Weijiang Xue, both of the Department of Nuclear Science and Engineering, and others have created a new version of a key component for lithium batteries, the cathode. They describe their concept as a “hybrid” cathode, because it combines aspects of two different approaches that have been used before: one to increase the energy output per pound (gravimetric energy density), the other for the energy per liter (volumetric energy density). They say the synergistic combination produces a version that provides the benefits of both, and more.

NUCLEAR ENERGY

[MIT continues progress toward practical fusion energy](#)

A year after announcing a major public-private collaboration to design a fusion reactor capable of producing more power than it consumes, researchers from MIT, including Professor Dennis Whyte, head of MIT’s Plasma Science and Fusion Center, presented an update on their progress. In a series of talks in January 2019, they detailed the effort’s continuing work to bring about practical fusion power—based on the reaction that provides the sun’s energy—on a faster timescale than any previous efforts.

SOLAR ENERGY

[Game-changing solar energy and nanotechnologies](#)

Vladimir Bulović, the Fariborz Maseeh (1990) Chair in Emerging Technology, director of the Organic and Nanostructured Electronics Laboratory, and founding faculty director of MIT.nano, discusses his work on creating next-

generation, lightweight, flexible photovoltaics that could change the way the world deploys solar energy systems.

[Solar, renewables, energy transformation reshaping the geopolitical landscape](#)

Sergey Paltsev, deputy director of the MIT Joint Program on Science and Policy of Global Change and a senior research scientist at MITEI, discusses the degree and extent to which solar and other clean, decentralized renewable energy resources have the potential to reshape the geopolitical landscape, and what that may portend for the future of international relations.

ELECTRIC POWER SYSTEMS

[Protecting our energy infrastructure](#)

Using their “cybersafety” methodology, Professor Stuart Madnick and cybersecurity researcher Shaharyar Khan, both of the MIT Sloan School of Management, and Professor James L. Kirtley, Jr. of electrical engineering and computer science show that today’s energy systems are rife with vulnerabilities to cyberattack, and share a new methodology for analyzing and strengthening its cybersecurity.

TRANSPORTATION

[A novel global urban typology framework for sustainable mobility futures](#)

Christopher Zegras, associate professor of urban studies and planning, discusses the implications of a new framework for researchers and planners and investigates the relationships between mobility and environmental sustainability indicators. The new typologization spans 331 cities in 124 countries, with a sample representing 40% of the global population.

[MIT says we're overlooking a near-term solution to diesel trucking emissions](#)

Daniel Cohn, a MITEI research scientist, and Leslie Bromberg, a principal research engineer at MIT's Plasma Science and Fusion Center, published a paper with the Society of Automotive Engineers, suggesting that the best way forward is not to wait for all-electric or hydrogen-powered trucks, but to build a plug-in hybrid electric truck with an internal combustion engine/generator that can burn either gasoline or renewable ethanol or methanol.

ENERGY AND CLIMATE ECONOMICS AND POLICY

[Study: For low-income countries, climate action pays off by 2050](#)

Successful global efforts to substantially limit greenhouse gas emissions would likely boost GDP growth of poorer countries over the next 30 years, according to new research from the International Food Policy Research Institute and the MIT Joint Program on the Science and Policy of Global Change. Researchers including Sergey Paltsev, the deputy director of the MIT Joint Program on the Science and Policy of Global Change, examine the impact global climate change mitigation would have on the economies of poorer countries—specifically Malawi, Mozambique, and Zambia.

ADDITIONAL LOW-CARBON ENERGY RESEARCH

[Finding novel materials for practical devices](#)

Heather Kulik, an assistant professor of chemical engineering, and graduate student Jon Paul Janet are using neural networks coupled with genetic algorithms to examine huge databases of transition metal compounds for potential use in practical devices. Using the same technique, graduate student Aditya Nandy is designing better catalysts for methane conversion reactions.

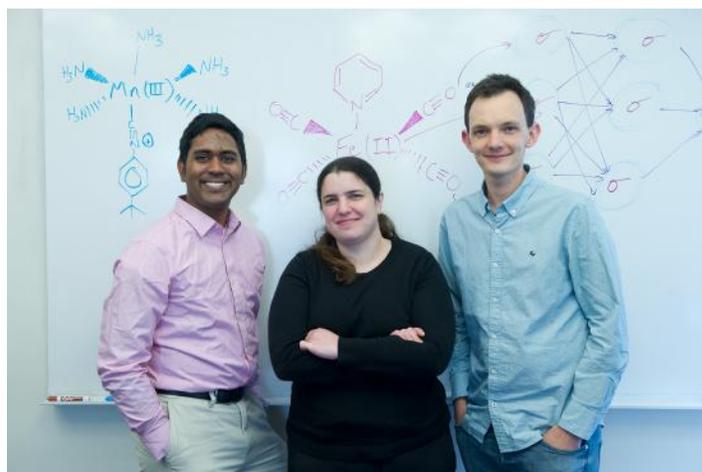
[Removing CO₂ from power plant exhaust](#)

Assistant Professor Betar Gallant and graduate student Aliza Khurram are developing a novel battery that could both capture carbon dioxide in power plant exhaust and convert it to a solid ready for safe disposal.

ENERGY IN THE DEVELOPING WORLD

[MIT receives \\$30 million to help address energy challenges in Egypt](#)

An award from the U.S. Agency for International Development will support research collaborations through the new Center of Excellence in Energy at Ain Shams University in Cairo, Egypt. Ahmed Ghoniem, the Ronald C. Crane Professor in MIT's Department of Mechanical Engineering, will co-lead the Center. Over the next five years, the team will work to build the research, education, and entrepreneurial capacity of Ain Shams, Mansoura, and Aswan universities to address the country's most pressing energy-related problems.



Assistant Professor Heather Kulik (center) and graduate student Jon Paul Janet (right) are using neural networks coupled with genetic algorithms to examine huge databases of transition metal compounds for potential use in practical devices. Using the same technique, graduate student Aditya Nandy (left) is designing better catalysts for methane conversion reactions. *Photo: Stuart Darsch*

Tata Center for Technology and Design

During the 2018-2019 academic year, the [Tata Center for Technology and Design](#) supported 40 Master's and PhD students as they traveled abroad at least twice a year to immerse themselves in the social, political, and economic aspects of their research in the developing world. Now at the end of its seventh year, the Tata Center has seen students work extensively throughout India, as well as in Nepal, Kenya, Nigeria, Tanzania, Uganda, Rwanda, Brazil, Colombia, and Venezuela. Their experiences abroad inform their ongoing research with the goal of catalyzing positive social impact in the form of policy support and affordable products and services. Through support for these students, and through thoughtfully crafted research projects in the fields of energy, water, environment, housing, health, and agriculture, the Tata Center advances its mission of bringing technical talent and experience to bear on the challenges of the developing world.

To date, Tata Center-funded projects have led to more than 45 patent disclosures to MIT's Technology Licensing Office. Eleven projects are already on the path to commercialization through startups, and other projects have resulted in licensing arrangements, while many others have attracted follow-on funding from government agencies and commercial sponsors. As projects continue to mature, the Tata Center continues to translate these projects into practice partly in cooperation with the Tata Trusts and the Foundation for Innovation and Social Entrepreneurship, a nonprofit incubator established in Bangalore by the Trusts with the government of India.

The Tata Center hosted its fourth annual Symposium at MIT in 2018 to discuss the topic, "Translating research into impact at the Tata Center," and to participate in sectorial workshops, "Building bridges for impact," on the second day of the event. The event also featured poster

sessions and presentations that introduced the Center's newest projects in agriculture, energy, environment, health, housing, and water.

Global Commission to End Energy Poverty

MITEI researchers are supporting an ambitious new effort initiated in late 2018 to develop a viable pathway for providing electricity services to hundreds of millions of under-served homes and businesses more quickly and more cost effectively than the current trajectory. The [Global Commission to End Energy Poverty](#) is led by The Rockefeller Foundation and co-chaired by Ernest Moniz, special advisor to the MIT President, professor emeritus, and former U.S. Secretary of Energy; Dr. Rajiv Shah, president of the Rockefeller Foundation; and Akinwande Adesin, president of the African Development Bank. Robert Stoner, MITEI deputy director and director of the Tata Center for Technology and Design, and Ignacio Perez-Arriaga, a visiting professor at MITEI, lead the research team, which is focused on identifying and addressing the barriers to achieving universal, economically impactful electrification. Stoner also serves as Secretary of the Commission.

The Commission convened for the first time in September 2019 in Italy, and will publish its findings and recommendations at the United Nations General Assembly in 2020. Commissioners include leaders from utilities, off-grid companies, multilateral development banks, academics, and from across the electricity and development sectors.

The Global Commission's leaders hope to define an actionable long-term agenda underpinned by commitments by the major development banks, private firms and investors, governments, and national utilities that will make universal electrification a reality by 2030.

Education



Moises Trejo, a student participating in the Discover Energy First-Year Pre-Orientation Program (DE FPOP) tests the flexibility of a wind turbine blade at the Wind Technology Testing Center.

Photo: Corey Watanabe



Technology and Policy Program master's students Annette Brocks (left) and Nelson Lee (right) engage in a rapid prototyping exercise with Tufts master's student Alexis Washburn (center) and other participants during a Martha's Vineyard net-zero carbon design thinking workshop. *Photo: Maud Bocquillod*



Professor David Hsu (center) discusses findings with Yeva Yin (left) and Luis Garcia (right). Garcia and Yin, along with Grace Bryant (not pictured), worked with Hsu to analyze political spending and corresponding utility rates during their summer UROP through the MIT Energy Initiative. *Photo: Kelley Travers*

Education

MITEI's role as an educator of future energy change agents is critical to its mission as a catalyst for tomorrow's low-carbon energy solutions. Through programs created for undergraduate and graduate students, MITEI provides a robust educational toolkit for MIT students who want to contribute to the energy transition. These programs allow students to take classes; conduct research in diverse areas, from energy science and social science to technology and engineering; practice their skills; and network with peers and professionals. MIT faculty members work with MITEI's education team to develop the curriculum and act as advisors to aspiring and current energy students.

Students interested in energy at MIT can start as soon as they step onto campus: MITEI runs the Discover Energy First-Year Pre-Orientation Program at the end of the summer before classes begin. The journey continues in the classroom, where undergrads can take interdisciplinary courses through the Energy Studies Minor and participate in laboratory research through the MITEI Undergraduate Research Opportunities Program (UROP).

Students participating in MITEI's Solar Spring Break program have the opportunity to immerse themselves in energy practice by installing solar panels in underserved communities. In 2019, MITEI partnered with GRID Alternatives, a California nonprofit where Anna Bautista '05 (Electrical Engineering and Computer Science) is vice president of construction and workforce development.

Graduate students and postdocs receiving funding from MITEI through the member education fund are an equally important part of the Initiative's energy education ecosystem. In addition to contributing their own research to MITEI's areas of inquiry and collaborating with researchers on white papers and studies, graduate students mentor UROP students and contribute to the development of the Energy Studies Minor curriculum. Through the Society of Energy Fellows, MITEI also hosts activities for graduate student fellows, including dinner meetings with sponsors at MITEI's Annual Research Conference and a range of informational gatherings and networking events.

MITEI Education Program Highlights:

Energy Studies Minor: After two years of hard work, the revised curriculum created by the Energy Studies Minor Oversight Committee has been accepted by the Committee on Curricula and was published in August 2019. Updates include improving curriculum flexibility across fall and spring offerings, as well as increasing the number of advisors across academic departments to provide a go-to resource for students planning their course schedules.

Undergraduate energy research: MITEI supported 56 student projects through the [MITEI Undergraduate Research Opportunities Program](#) during the 2019 academic year, bringing its total number of sponsored projects up to 531, including Tata Center and Center for Energy and Environmental Policy Research projects. This cohort's research spanned a breadth of unique subjects, among them solar-driven sterilization under ambient pressure and low solar flux, cost modeling of solar in sub-Saharan Africa, and grid-scale energy storage.

Graduate Fellows: MITEI welcomed 26 new graduate students and postdocs to the Society of Energy Fellows in 2018-2019. The Energy Fellows network now totals more than 430 current and former graduate students and postdoctoral fellows, spanning 20 MIT departments and divisions and all five MIT schools. This year's fellowships are made possible through the generous support of six MITEI member companies: Commonwealth Fusion Systems, Chevron, Eni S.p.A., ExxonMobil, Shell, and Total; and one former member, Bosch.

Solar Spring Break: In March 2019, nine undergraduate students and two graduate students participated in MITEI's Solar Spring Break program in partnership with the nonprofit GRID Alternatives. The students installed solar panels on the home of a low-income family in Los Angeles, California over the course of a week. Participants

met the homeowner and heard firsthand about the impact of their work. They also attended various networking and educational events.

First-Year Pre-Orientation Program: MITEI's [summer 2018 energy pre-orientation program](#) sent 15 first-year students to on- and off-campus locations to learn about opportunities for energy research and education at MIT. Activities included a meeting with representatives from the Institute's Undergraduate Energy Club, a tour of a wind turbine blade testing facility, an energy economics workshop with Professor Jing Li of the Sloan School of Management, and a workshop on building DC motors with Professor Steven Leeb of the Department of Electrical Engineering and Computer Science. Students also met with professors in informal settings, including William Green (Chemical Engineering), Robert Jaffe (Physics), Julia Ortony (Materials Science and Engineering), and David Hsu (Urban Studies and Planning).

Career Insights Speaker Series: This year, rather than focusing on small group meetings with individuals, the MITEI Education Office held a day-long forum in April 2019 on careers in energy called, "Working the Energy Transition." Throughout the day, more than 50 undergraduate and graduate students had the opportunity to meet with 22 representatives from industry and government, gaining insights into the many options for careers in energy.

Conversations with energy leaders: MITEI works with the MIT Energy Club throughout the academic year to organize the monthly E³ dinner series. The dinner series brings MIT energy community members together with distinguished alumni in the energy industry. The dinners are intended to not only foster connections between alumni and current students, but also to build bridges between current students from different MIT undergraduate and graduate communities over shared interests in energy. Speakers for 2018-2019 dinners included Matthew Zedler '07, head of product and application engineering at

Lockheed Martin Advanced Energy Storage, LLC, and Sandhya Murali '15, co-founder and chief operating officer of Solstice, an award-winning social enterprise dedicated to expanding access to clean energy to all Americans.

Online energy courses: To help train the global network of professionals needed to realize a low-carbon energy future, the MITEI education team has organized a new series of [online energy courses](#) based on interdisciplinary MIT graduate classes currently taught on campus. The courses will be MITx massive open online courses slated to run on the edX platform. The MITx courses will engage four critical aspects of future electricity systems: load and demand-side management; economics and regulation; production; and distribution and transmission. The first class, Professor Christoph Reinhart's 4.464 Environmental Technologies in Buildings, is projected to launch in early 2020.

Energy Field Trip: In June 2019, Antje Danielson, MITEI's director of education, led a group of six undergraduate students to visit energy sites in Denmark and Germany. The trip included visits to the island of Samsø and to a radioactive waste storage facility. This pilot program was aimed at rising sophomores as a means of furthering engagement with the energy field beyond the classroom and encouraging student enrollment in the energy studies minor.

Annual Research Conference: At MITEI's December 2018 Annual Research Conference, 26 undergraduate students presented posters of energy-related work in a wide range of disciplines, from electrochemistry to architecture. The students, all MITEI-sponsored participants in the energy UROP, had the opportunity to network with energy professionals while showcasing their research.



During the class 15.366 Energy Ventures, Senior Lecturer Francis O'Sullivan (left) leads a discussion with a team working on contactless steam generation technology for heating water in remote locations. The graduate students with him are, from left: Brian Gaudio, Robert Addy, Matt Severson (of Harvard Business School), Bidusha Poudyal, and Yoichiro Tsurimaki. *Photo: Kelley Travers*

Outreach



As part of MIT Climate Night, MIT Vice President for Research Maria Zuber (center) talks with John Fernández (left), director of the MIT Environmental Solutions Initiative, and Robert Armstrong, director of the MIT Energy Initiative. *Photo: Kelley Travers*



Yang Shao-Horn, the W.M. Keck Professor of Energy at MIT (center), engages with the audience during MITEI's Spring Symposium. From left to right: Cathy Choi, Cummins; Yogesh Surendranath, MIT; and Clay Sutton, ExxonMobil. *Photo: Kelley Travers*



At the 2018 Annual Research Conference, Antonio Torralba, director of the MIT Quest for Intelligence and director of the MIT-IBM Watson AI Lab, introduces a panel examining where and how more capable intelligent machines and methods can be applied to the most difficult energy challenges. *Photo: Eric Haynes*

Outreach

MITEI's fact-based analysis of current energy topics informs public policy, fosters dialogue within the academic research community, and provides the public with context on vital issues. Convening events throughout the year, MITEI hosts thought leaders from across the energy value chain. MITEI staff, faculty affiliates, and graduate students share their research and perspectives at domestic and international events. Staff members also participate in Institute-wide efforts focused on addressing climate change. MITEI's communications team highlights the research and achievements of faculty and students through articles, media outreach, social media, podcasts, and other digital and print platforms to reach a diverse audience.

Outreach Program Highlights

MIT Climate Symposia: During the 2019-2020 academic year, MIT will host [six symposia](#) to examine the urgent challenge of climate change. This series will draw upon MIT's work to date on the MIT Plan for Action on Climate Change and consider the current state of knowledge on key aspects of this global problem. These

discussions will provide an important opportunity for engagement among members of the MIT community, other leading researchers, industry leaders, and policymakers to explore options for facilitating the necessary transition to a low-carbon economy. MITEI is providing strategic guidance and operational support for the six symposia and many MITEI-affiliated faculty and staff members are speaking at the events.

MIT Plan for Action on Climate Change: MITEI continues to support MIT's [Plan for Action on Climate Change](#) with the ongoing development of its interdisciplinary Low-Carbon Energy Centers, which include new types of member companies, energy systems analysis and studies, work in developing countries, and education.

Guest speakers: Leading executives in policy, academia, and industry gave talks at MITEI-hosted events. Speakers included [Naomi Hirose](#), executive vice chairman of Fukushima Affairs at the Tokyo Electric Power Company; [Frances Beinecke](#), past president of the Natural Resources Defense Council; Asegun Henry, director of the Atomistic Simulation and Energy Research Group; and [Michael R. Wasielewski](#), executive director

of the Institute for Sustainability and Energy at Northwestern University.

MIT Climate Night: On April 25, 2019, MITEI co-hosted a [Climate Night](#) with the MIT Environmental Solutions Initiative as part of an Earth Week celebration. The event featured a climate conversation among MIT Vice President for Research Maria Zuber, MIT Energy Initiative Director Robert Armstrong, and MIT Environmental Solutions Initiative Director John Fernández, as well as open discussion.

Annual Research Conference 2018: MITEI's signature [annual conference](#) brought together energy researchers, policymakers, and industry members working on cutting-edge technologies and business models for the transition to a low-carbon future. Panels ranged from the latest developments in the fight against climate change to innovations for creating a better business environment in which energy startups can thrive. A special segment of the conference, presented in collaboration with the recently launched MIT Quest for Intelligence, focused on the role of artificial intelligence and machine learning in the energy sector.

C3E 2018 Women in Clean Energy Symposium: The [U.S. C3E Initiative](#) aims to advance clean energy by closing the gender gap and enabling the full participation of women in the clean energy sector. In December 2018, the seventh annual Clean Energy, Education, and Empowerment (C3E) Women in Clean Energy Symposium and Awards took place at Stanford University. Stanford Energy hosted the event in collaboration with the U.S. Department of Energy, MITEI, and Texas A&M Energy Institute. The [conference](#) featured award presentations to mid-career women and a lifetime achievement award presentation, as well as diverse speakers—including MIT professor of mechanical engineering Betar Gallant—and conversations on strategies and technologies to enable the transition to a low-carbon future. The eighth symposium took place this November 13-14 at Texas A&M; MITEI will host in 2020.

Spring Symposium: In June 2019, MITEI held a [symposium](#) to investigate the resurgence of global interest in low-carbon hydrogen. More than 100 people joined MIT researchers and industry leaders to learn about the current state of hydrogen in the energy system and the ways in which it could be employed as part of a low-carbon future. The day-long event, sponsored by MITEI Associate Members Cummins and Électricité de France, featured sessions on topics ranging from transportation and infrastructure to technological advances coming out of laboratories to government policies.

Tata Center Symposium: The Tata Center held its fourth annual symposium in October 2018. The two-day event, titled "[Translating research into impact](#)," highlighted the need to invest in technologies for the developing world from a market-driven perspective. Speakers included Manoj Kumar, head of entrepreneurship and innovations at Tata Trusts; Maurizio Vecchione, executive vice president of Global Good and Research; and Ernest Moniz, the Cecil and Ida Green Professor of Physics and Engineering Systems emeritus and former U.S. Secretary of Energy.

Support for campus energy events: MITEI sponsored and provided staff support for numerous campus energy events, including the student-run [MIT Energy Conference](#)—which also featured several MITEI speakers—the Undergraduate Energy Research Fair, the Energy Career Fair, and the Energy Hackathon.

Podcasts: MITEI produced and released a number of [podcasts](#) that explore energy from a variety of angles to make its research more accessible to a large audience and to illustrate how energy impacts our everyday lives. Subjects covered in FY2019 include electricity markets, artificial intelligence, batteries and storage, and game-changing fusion.

STAY CONNECTED

Keep up with MITEI's latest research, news, and events:

To sign up for MITEI's weekly newsletter, visit: energy.mit.edu/subscribe

Events calendar: energy.mit.edu/events

Energy Futures Magazine: energy.mit.edu/energyfutures

"Future of" studies: energy.mit.edu/futureof

Latest MITEI publications: energy.mit.edu/publications

Podcast: energy.mit.edu/podcast

Connect with us on social media:

 facebook.com/mitenergy   [@mitenergy](https://twitter.com/mitenergy)

Contact us:

askmitei@mit.edu

Mailing address:

77 Massachusetts Avenue, E19-307
Cambridge, MA 02139

