



GLOBAL CHANGES

MIT JOINT PROGRAM ON THE SCIENCE & POLICY OF GLOBAL CHANGE
SPRING 2020 NEWSLETTER





OUR RESEARCH MISSION

Advancing a sustainable, prosperous world through scientific analysis of the complex interactions among co-evolving, interconnected global systems.

The pace and complexity of global environmental change is unprecedented. Nations, regions, cities and the public and private sectors are facing increasing pressures to confront critical challenges in future food, water, energy, climate and other areas. Our integrated team of natural and social scientists produces comprehensive global change projections under different environmental, economic and policy scenarios. These projections enable decision-makers in the public and private sectors to better assess impacts, and the associated costs and benefits of potential courses of action.

OUR VISION

We envision a world in which community, government and industry leaders have the insight they need to make environmentally and economically sound choices.

Toward that end, we provide a scientific foundation for strategic investment, policymaking and other decisions that advance sustainable development.

IMPACT: WHAT WE DO

The MIT Joint Program:

- Combines scientific research with risk and policy analyses to project the impacts of—and evaluate possible responses to—the many interwoven challenges of global socioeconomic, technological and environmental change.
- Communicates research findings through our website, publications, workshops and presentations around the world, as well as frequent interactions with decision-makers, media outlets, government and nongovernmental organizations, schools and communities.
- Cultivates and educates the next generation of interdisciplinary researchers with the skills to tackle ongoing and emerging complex global challenges.

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MIT JOINT PROGRAM ON THE SCIENCE AND POLICY OF GLOBAL CHANGE

Ronald Prinn
John Reilly
Co-Directors

Sergey Paltsev
C. Adam Schlosser
Deputy Directors

Anne Slinn
*Executive Director for
Research*

Horacio Caperan
*Executive Director for
External Affairs*

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Mark Dwortzan
Editor/Writer

Jamie Bartholomay
Designer/Copy Editor

Assessing and alleviating climate risk

Joint Program research empowers decision-makers facing critical choices

A strong focus on climate-related financial risk has emerged in the past two years. Investors, particularly large institutional investors, have increasingly sought to understand whether the companies they're investing in are exposed to climate risk. Central banks, particularly those in Europe, have also been concerned about systemic risks. For good reason: during the financial crisis of 2008, the failure of a few large financial institutions threatened the entire system.

Similar to the financial stress tests developed at that time, the Bank of England is now calling for [climate stress tests for banks](#). We're also seeing [bond rating agencies](#) begin to assess the vulnerability of cities and communities to climate risk as a matter of course. The measures investors and the broader financial community are taking are prudent, given the developing climate risk across the globe. In general, the community has identified two types of risk: transition risk—the potential for fossil fuel assets to lose value in a rapid transition to a low-carbon economy—and physical risk—exposure to climate change and/or weather extremes.

Assessing climate risk

The challenges in assessing these risks are formidable, but ultimately such assessment may prove to be one of the most promising ways to change the direction of the global economy. As banks, regulators and investors increasingly demand transparent disclosure of risks, industries will themselves be forced to assess the risks they face. And that assessment will lead to highly consequential decisions.

Concerns about transition risk have already impelled some major financial institutions to announce that they will not be involved with the coal industry or with carbon dioxide-intensive industries such as oil sands. On the physical risk side, several measures, from [flexible water infrastructure design](#) to [proactive power grid management](#), can be taken to reduce potential damage in the face of weather extremes.

Possibly the biggest challenge in addressing transition and physical risks is to create a set of best practices for assessing them. There is a principal-agent problem, as we saw in the financial crisis. Rating agencies responsible for assessing risks but also eager to please clients failed to do an adequate job of assessing risks, and so they were not transparent to the investment community. That same problem may emerge in climate risk assessment, where an emerging industry of climate risk assessment consultants, bidding for business, may underprice the cost of doing a thorough risk assessment, and thus fail to reveal the real risk a company faces.



John Reilly and Ronald Prinn, MIT Joint Program Co-Directors.

For that reason, we think there is an important role for strong, independent assessment, or at least the development of best practices for climate risk assessment. We're working at MIT to see if that is a role we can play.

The modeling system that we've developed over the past three decades has a lot of capabilities that can be applied to this problem on both the transition and physical risk sides. Some preliminary analysis appeared in our recent [Joint Program Report 339](#), "MIT Scenarios for Assessing Climate-Related Financial Risk." In this report we investigated a range of climate policy scenarios to develop various metrics (e.g. carbon and fossil fuel prices, levels of sectoral production, and estimates of the value of stranded assets associated with a range of energy transitions) that can then be used in further analysis to help identify climate-related financial risk in the specific investment portfolios of individual financial institutions. We also presented a set of methods appropriate for evaluating the physical risk of climate change.

Alleviating climate risk in vulnerable nations

The Joint Program's modeling framework is also a valuable tool for identifying ways to help alleviate the risks of climate change through adaptations that increase the resilience of nations to climate extremes. Challenges that arise include forecasting and communicating these extremes, and designing and building affordable transportation, urban infrastructure, relocation, water management, and agricultural systems that make countries more resilient to them. There is now widespread concern that the world's poorest nations are also the most vulnerable to climate risks, with urgent needs for the assistance from the developed world.

To that end, our framework is a core component of a proactive climate risk assessment system that was just selected as

one of the Top 100 proposals in the John D. and Catherine T. MacArthur Foundation's [100&Change](#) competition for a single \$100 million grant to help solve one of the world's most critical social challenges. This system, known as the Climate Resilience Early Warning System Network ([CREWSNET](#)), aims to empower climate-threatened populations to make timely, science-driven decisions about their future. Starting with western Bangladesh but scalable to other vulnerable nations across the globe, CREWSNET will combine the Joint Program's leading-edge climate forecasting and socio-economic analysis with innovative resilience services to enable people to make and implement informed decisions about adaptation and relocation—and thereby minimize loss of life, livelihoods and property.

We now welcome your thoughts on best practices for assessing physical and transition risks, how to alleviate these risks worldwide, and how the Joint Program can help support your decision-making in this space.

—*John Reilly and Ronald Prinn, Co-Directors*

MIT Joint Program News Releases:

Latest research developments and their implications

The following summaries are listed by primary research focus area, but may span multiple research focus areas. For full articles, please visit our website at globalchange.mit.edu.

Earth Systems

Changes and risks to interconnected land, ocean, atmosphere and biosphere systems

One hundred years of atmospheric chemistry [🔗](#)

Joint Program Co-Director Ronald Prinn presents highlights in science keynote at 100th Annual Meeting of the American Meteorological Society

MIT Professor of Atmospheric Science Ronald Prinn described how the field of atmospheric chemistry has advanced from 1920 to 2020 in a core science keynote address at the 100th Annual Meeting of the AMS, the world's largest yearly gathering for atmospheric sciences experts. Speaking at the Boston Convention and Exhibition Center on January 14, Prinn explored key developments in the field.

Assessing changes and risks to the oceans, land and atmosphere [🔗](#)

Joint Program researchers present latest findings at American Geophysical Union Fall Meeting

Thirteen Joint Program researchers and affiliates delivered or contributed to eight oral and poster presentations at the AGU 2019 Fall Meeting on December 9-13 at the Moscone Center in San Francisco. Their presentations showcased in-depth studies of Earth systems, managed resources, modeling tools and techniques, and policy scenarios.

REFERENCES

Landry, E., C.A. Schlosser, Y.H.H. Chen, J. Reilly and A. Sokolov (2019). *MIT Scenarios for Assessing Climate-Related Financial Risk*. Joint Program Report Series Report 339, 72 p., December. <https://globalchange.mit.edu/publication/17392>

Landry, E., H. Jacoby, S. Paltsev et al. (2019). *Climate-related Financial Disclosures: The Use of Scenarios*, an MIT Office of the Vice President for Research report. <https://climate.mit.edu/ClimateFinanceDisclosuresScenarios>

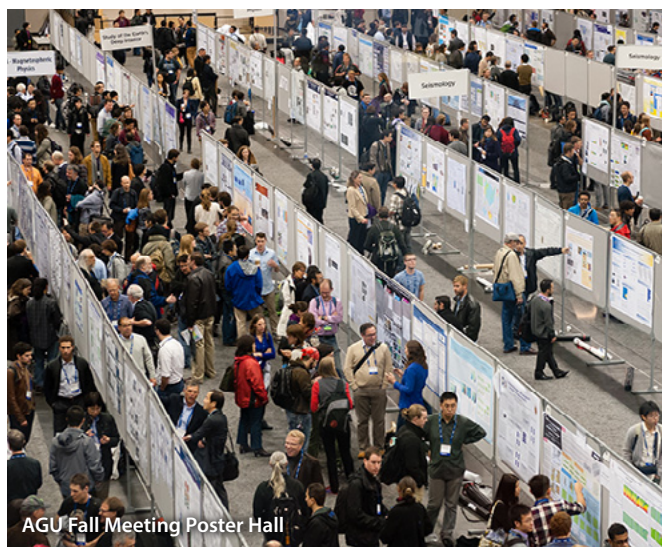
MIT DEPARTMENT ACRONYMS

Due to space considerations, MIT departments, labs and centers referenced here are referred to by their acronyms.

CEEPR	Center for Energy and Environmental Policy Research
EAPS	Earth, Atmospheric and Planetary Sciences
IDSS	Institute for Data, Systems, and Society
MITEI	MIT Energy Initiative

MIT Joint Program in the Media:

Latest coverage of our research



AGU Fall Meeting Poster Hall

COMMENTARY Five reasons climate change is the worst environmental problem the world has ever faced [🔗](#)

LA Times – There are five features that combine to make global warming a more vexing environmental crisis than any we have faced before.

Emissions of potent greenhouse gas have grown, contradicting reports of huge reductions [↗](#)

An international team of scientists has found atmospheric levels of HFC-23 growing at record values (Coverage: [The Guardian](#), [Technology Review](#))

Despite reports that global emissions of HFC-23 were almost eliminated in 2017, Joint Program Co-Director Ronald Prinn and co-authors of a study in the journal *Nature Communications* show that concentrations were increasing at an all-time record by 2018. Scientists are concerned, because HFC-23 is a very potent greenhouse gas: one metric ton of its emissions is equivalent to the release of more than 12,000 metric tons of CO₂.

Experts urge “full speed ahead” on climate action [↗](#)

Panelists at MIT climate change symposium discuss climate science findings and stress urgent need for action ([Video](#))

In the first of [six symposia](#) on climate change planned at MIT this academic year, panels of climate science specialists, including Joint Program Co-Director John Reilly, described

the state of knowledge on the subject today. They also discussed areas where more research is needed to pin down how severely and quickly climate change’s effects may occur, and what kinds of actions are urgently needed to address the enormous disruptions climate change will bring.

Seeding oceans with iron may not impact climate change [↗](#)

Study finds Earth’s oceans contain just the right amount of iron; adding more may not improve their ability to absorb carbon dioxide (Coverage: [New York Times](#), [Xinhua](#))

To help stem escalating CO₂ emissions produced by the burning of fossil fuels, some scientists have proposed seeding the oceans with iron—an essential ingredient that can stimulate phytoplankton growth. Such “iron fertilization” would cultivate vast new fields of phytoplankton, particularly in areas normally bereft of marine life. An MIT study in the journal *PNAS* suggests that iron fertilization may not have a significant impact on phytoplankton growth, at least on a global scale.

Managed Resources

Changes and risks to managed agriculture, water, land and energy systems

J-WAFS zeroes in on food security as agricultural impacts of the climate crisis become more apparent [↗](#)

Joint Program researchers contribute to new MIT report on climate, agriculture, water and food security

Most IPCC reports emphasize greenhouse gas emissions from energy and transportation sectors, along with weather and sea-level impacts of climate change. The *Special Report on Climate Change and Land* presents data and analyses addressing the substantial contributions of agriculture to climate change and how the climate crisis is projected to jeopardize global food security if urgent action is not taken.



Focusing on four major crops—maize, rice, soybean and wheat—a study in the journal *Agricultural and Forest Meteorology* provides a reliable and computationally efficient alternative to globally gridded crop yield models.

Estimating irrigated crop yields and irrigation water requirements [↗](#)

New method enables a more comprehensive assessment of the impact of climate change on agriculture

Statistical emulators of global gridded crop models are designed to provide a far less computationally intensive way to assess the impact of climate change on crop yields. A study in the journal *Agricultural and Forest Meteorology* advances statistical emulators to provide an accessible tool to assess the impact of climate change on irrigated crop yields and irrigation water withdrawals.

Taking the carbon out of construction [↗](#)

Engineered wood could cut building emissions and costs

New research in the journal *Energy Economics* explores the potential environmental and economic impact in the U.S. of substituting lumber for energy-intensive building materials. The study shows that lumber products offer one potential cost-effective option for reducing emissions from sectors such as cement, iron and steel, and fabricated metal products—by reducing demand for these products.

A brief history of oil, coal and natural gas [↗](#)

In ten-minute MIT Climate podcast, MIT energy economist John Reilly demystifies fossil fuels

Joint Program Co-Director John Reilly explains the different kinds of fossil fuels and how they compare to each other, fracking and its impact on energy use and CO₂ emissions in the U.S., and the kinds of decisions needed to transition to clean energy.

Infrastructure & Investment

Physical and transition risk; adaptation and resilience to climate change and extreme events

Reducing risk, empowering resilience to disruptive global change [↗](#)

Workshop highlights how MIT research can guide adaptation at local, regional and national scales

Assessing the magnitude of global change risks over multiple decades and identifying strategies to prepare for them will be essential to making societies and economies more resilient and sustainable. Toward that end, the Joint Program's Adaptation-at-Scale workshop, held on January 10 at MIT, covered risks and resilience strategies for food, energy and water systems; urban-scale solutions; predicting the evolving risk of extreme events; and decision-making and early warning capabilities.

MIT report provides guidance on climate-related financial disclosures [↗](#)

Recommendations could help companies deliver more useful disclosures to investors on risks they face due to climate change

An MIT white paper *Climate-Related Financial Disclosure Disclosures: The Use of Scenarios* outlines a series of recommendations on how companies, particularly those in the oil and gas industry, can use scenario analysis to effectively disclose risks and opportunities they face as a result of

global climate change. Drawing on Joint Program expertise, the report aims to help companies produce more useful scenario-based disclosures, and help the financial community better evaluate such disclosures.

MIT-powered climate resilience solution among top 100 proposals for MacArthur \$100 Million Grant [↗](#)

High-scoring 100&Change applications featured in Bold Solutions Network

The John D. and Catherine T. MacArthur Foundation selected the Climate Resilience Early Warning System Network ([CREWSNET](#)), a system co-developed by MIT, as one of its Top 100 highest-scoring proposals in its 100&Change competition in 2020 for a single \$100 million grant to help solve one of the world's most critical social challenges. Drawing on Joint Program expertise, CREWSNET aims to empower climate-threatened populations to make timely, science-driven decisions about their future.

Aging dams in Boston's MetroWest area pose danger [↗](#)

MetroWest Daily News – Local infrastructure should be designed based on more recent storm data, says Joint Program Research Scientist Kenneth Strzepek.

An Army Corps of Engineers flood model depicting the Ala Wai watershed after a 100-year rain event. The owner of a local design firm described the Ala Wai Flood Control Project as the largest climate impact project in Hawaii's modern history.



Energy Transition

National and global projections of the future energy mix; prospects for different sectors and technologies

Pathways to a low-carbon future [↗](#)

How the global energy mix could change over the next 20 years

Energy projections are stakeholders' sharpest tool in assessing the near- and long-term physical and financial risks associated with climate change and the world's ongoing transition to a low-carbon energy system. Combining the results from multiple sources, a study in the journal *Economics of Energy & Environmental Policy* provides additional insight into the evolution of the global energy mix.

MITEI's 2019 Annual Research Conference highlights "energy at scale" and engagement as levers of decarbonization [↗](#)

Joint Program research assistant Erin Smith discussed the role of economics and policy in scaling up low-carbon energy technologies

"Government and business play a crucial role in scaling up new technologies," said Smith, a master's student at MIT's IDSS, adding that government cooperation with industry is an effective method of keeping up climate-friendly policy momentum. "To achieve our climate goals is going to require a massive investment in and buildup of our infrastructure."

ENERGY TRANSITION - CONT'D

MIT Energy Initiative report charts pathways for sustainable personal transportation [↗](#)

Technological innovations, policies and behavioral changes will all be needed to reach Paris climate agreement targets (Coverage: [WBUR](#), [Technology Review](#), [E&E News](#), [Smart Cities Dive](#), [Forbes](#))

Insights into Future Mobility, a multidisciplinary report released by the MIT Energy Initiative, explores how individual travel decisions will be shaped by complex interactions among technologies, markets, business models, government policies and consumer preferences—and the potential consequences as personal mobility undergoes tremendous changes in the years ahead. Several Joint Program researchers contributed to the report.

Getting to net zero [↗](#)

Joint Program workshop explores challenges and opportunities of scaling up low-carbon energy

Mobilizing the financial resources, technological advances, public opinion and political resolve needed to move toward net zero emissions will not be easy. At the Joint Program's Energy-at-Scale workshop on November 7 on the MIT Campus, participants discussed the potential of unique Joint Program assessment strategies and tools to quantify the economic and environmental impacts of large-scale decarbonization and support investment and policy decisions in this space.

Renewables can't get grid to net zero alone, MIT scientists say [↗](#)

Houston Chronicle – Joint Program Co-Director John Reilly presents findings from report on deep decarbonization on Capitol Hill.

Nuclear must be an important part of the climate conversation [↗](#)

Washington Examiner – Commentary cites Joint Program Report highlighting the need for diverse energy resources to power the grid.

COMMENTARY **Too much wind and solar raises power system costs** [↗](#)

Utility Dive – Deep decarbonization requires nuclear, says Joint Program Co-Director John Reilly.

MIT study: CO₂ cuts less pricey if nuclear is big part of the mix [↗](#)

Power Engineering – Keeping nuclear power vital may be the best way to reach aggressive carbon reduction targets while avoiding a steep carbon price.

COMMENTARY **Batteries are critical to the future electric grid, but they have their limits** [↗](#)

pv magazine – MIT Joint Program Co-Director John Reilly highlights constraints on batteries in an intermittent renewable-dominated power sector.

MIT Experts Say CAFE, low-carbon grid key to reduce vehicle GHGs [↗](#)

InsideEPA – Joint Program Research Scientist Jennifer Morris explains findings from Mobility of the Future report.



Getting to net zero: Over 10,000 tracking heliostats focus solar energy at the receiver on the 640 foot power tower at the Crescent Dunes Solar Thermal Facility, which provides more than 500,000 megawatt hours of electricity per year, available day or night through molten salt storage.

Policy Scenarios

Environmental and economic change under different climate, air pollution and economic policies

New LAE study quantifies air quality and climate impacts of aviation

MIT team found that air quality impacts of aviation emissions significantly exceed climate impacts (Coverage: [CNN](#))

New research from MIT's Laboratory for Aviation and the Environment has quantified the climate and air quality impacts of aviation, broken down by emission type, altitude and location. Writing in the journal *Environmental Research Letters*, the research team examines how this damage can be mitigated, and provides consistent comparative assessments of aviation emissions trade-offs, considering both climate and air quality impacts.

Global Futures: Assessing the global economic impacts of environmental change to support policy-making

Joint Program Deputy Director Sergey Paltsev serves as expert reviewer of new report for government and business decision-makers

This report summarizes the first results of the Global Futures initiative, which has developed an innovative new model to calculate the impacts of nature's decline on the world's economies, trade and industry. The research is timely and poses a stark warning to us all—that unless we reverse nature loss, trillions of dollars will be wiped off the world's economies, industries will be disrupted and the lives of millions will be affected.

Symposium explores challenges of adapting to climate change

Panelists at MIT climate change symposium discuss challenges of climate policy and adaptation. ([Video](#))

In the second of six MIT symposia on climate change for 2019-2020, seven experts from around the country tackled the topic of "challenges of climate policy." At the Oct. 29 event, Joint Program Founding Co-Director Emeritus Henry Jacoby noted that climate change reflects the "commons problem," where a few bad actors can undermine a large group's mutual dependence on common resources.

Synthetic biology: A new tool to tackle climate change?

MIT Joint Program researchers explore science and policy implications at BU workshop

Participants at Boston University's December workshop on synthetic biology and climate change considered a wide range of complex challenges and potential benefits of proposed synthetic biology approaches to reducing greenhouse gas emissions. Among the presenters and moderators were four researchers affiliated with the Joint Program who explored some of the scientific and policy implications of tackling climate change with a synthetic biology toolset.

Energy economics and air pollution

MIT Energy Initiative podcast features Joint Program Co-Director John Reilly and faculty affiliate Noelle Selin

Reilly and Selin: "The work that we've done in the past together has really tried to say, what policymakers are concerned about is the economy. If we can then think about impacts of air pollution on the economy as a percentage of GDP, that really gets a lot of people's attention."

COMMENTARY The secondhand smoke you're breathing may have come from another state

The Conversation – Joint Program-affiliated researchers call for ongoing investigation of, stricter controls on U.S. cross-state air pollution. (Republished in [Salon](#))

Elizabeth Warren blamed 3 industries for 70% of greenhouse gases. That muddles the picture.

Politifact – Joint Program Co-Director John Reilly highlights need for more precise language.

Climate change will grab globe's focus with summit, strikes

AP/ABC News – Joint Program Co-Director John Reilly says he's never seen a busier or more important time for climate action.

Chile cancels global climate, economic summits amid deadly protests

AP – Joint Program Founding Co-Director Emeritus Henry Jacoby emphasizes need for Paris Agreement signatories to resolve reporting rules in advance of COP25.

Trump can now start to pull U.S. out of Paris climate deal

AP – Joint Program Founding Co-Director Emeritus Henry Jacoby envisions lost U.S. prestige as other nations take leadership of ongoing Paris Agreement effort.

COMMENTARY A tragic misperception about climate change

The Hill – Ongoing U.S. disengagement from global climate action poses significant risks at home and abroad.

COMMENTARY Who is holding up the war on global warming? You may be surprised

The Hill – Good news: the American public finally appears to accept that global warming is a problem. Bad news: a substantial percentage of the public is unwilling to pay much to do anything about it.

COMMENTARY There is no Plan B on climate change

The Hill – In aftermath of COP25, Joint Program Founding Co-Director Emeritus Henry Jacoby and co-authors call for heightened efforts to inform the public of what's at stake in the climate crisis.

POLICY SCENARIOS - CONT'D

Reflections from the 2019 UN Climate Conference [↗](#)*MIT participants discuss their COP25 impressions and projects*

Joint Program Deputy Director Sergey Paltsev: “While the progress at COP meetings seems slow, the international cooperation is essential to tackle climate change. . . The task of climate change mitigation is enormously challenging and it is extremely important to keep involvement of all interested parties for the ultimate success. It is also very important for MIT to continue to participate in COPs to be an objective provider of information.”

MIT Policy Lab provides outreach support to help MIT researchers connect with the policy world [↗](#)*Lab enabled Joint Program researchers to inform Ohio legislators on drawbacks of a bill to remove the state’s Renewable Portfolio Standard*

Joint Program researcher Emil Dimanchev collaborated with Deputy Director Sergey Paltsev to create a model that



Joint Program Deputy Director Sergey Paltsev (left) and Dina Yahya, Ministry of Energy Brunei Darussalam

can calculate the health impacts of clean energy standards at the granular level of U.S. states, and thus determine the costs and benefits of state-level efforts to reduce carbon emissions. For the past two years, the Policy Lab has helped connect Dimanchev to the policy community concerned with state-level clean energy programs.

Regional Analysis*Science and policy studies at subnational, national and multinational levels***Half of U.S. deaths related to air pollution are linked to out-of-state emissions** [↗](#)*Study tracks pollution from state to state in the 48 contiguous United States (Coverage: [N.Y. Times](#), [CNN](#), [Reuters](#), [USA Today](#), [Bloomberg](#), [Boston Globe](#), [Scientific American](#), [USNWR](#), [PopSci](#), [Forbes](#))*

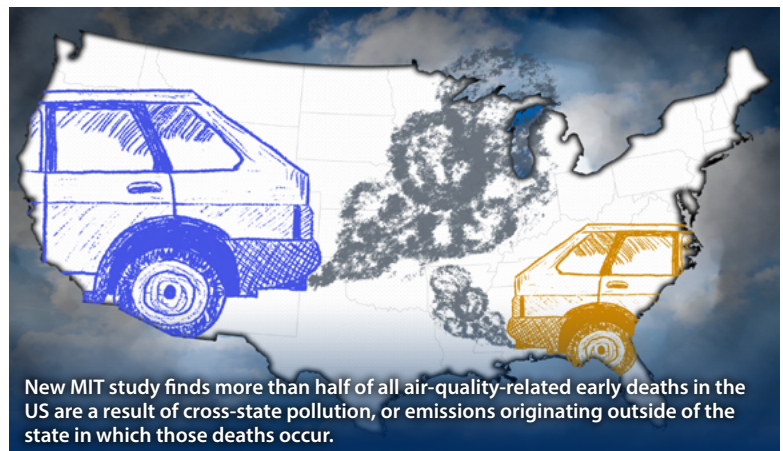
More than half of all air-quality-related early deaths in the U.S. are a result of emissions originating outside of the state in which those deaths occur, Joint Program-affiliated researchers report in the journal *Nature*. In general, the researchers find that when air pollution is generated in one state, half of that pollution is lofted into the air and carried by winds across state boundaries, to affect the health quality of out-of-state residents and increase their risk of early death.

Cutting mercury emissions in China [↗](#)*How concurrent climate and air pollution policies could prove a win-win combination*

A study in the journal *Environmental Science & Technology* co-authored by several Joint Program-affiliated researchers is the first analysis of the mercury benefits of climate policy in China to evaluate both mercury emissions and deposition impacts from the full range of economic sectors that emit mercury into the atmosphere. The study finds that climate policy in China can cut mercury pollution further when combined with policies implemented under the Minamata Convention alone.

How climate mitigation abroad can affect domestic economies [↗](#)*The case of Taiwan*

In a study in the journal *Climate Change Economics*, Joint Program researchers compare the impact on Taiwan’s economy of the Paris Agreement under two scenarios—one in which Taiwan fulfills its NDC unilaterally, the other in which Taiwan does so in the context of a global effort. They find that under the current NDCs of the Paris Agreement, Taiwan’s economy fares better under a global policy than it would by acting alone, because the global policy would substantially lower prices of the fossil fuels the nation imports to meet most of its domestic energy needs.



REGIONAL ANALYSIS - CONT'D

Greener and fairer [↗](#)

How environmental taxes can work for everyone in Spain and beyond

A study in the journal *Economics of Energy and Environmental Policy* co-authored by a Joint Program researcher shows that low-income households in Spain can benefit from environmental taxes if revenues are redistributed to all taxpayers. Using a computational model to assess the environmental and economic impacts of a green tax reform policy, the researchers find that the policy significantly reduces emissions without imposing economic hardship on any segment of the population.

COMMENTARY [Climate mitigation can support growth in developing countries](#) [↗](#)

Financial Times – IFPRI/MIT Joint Program study shows why.

[Tracking emissions in China](#) [↗](#)

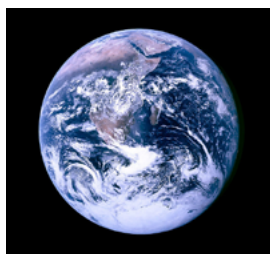
Energy Futures – Good news, some concerns.

[Renewable energy and carbon pricing policies](#) [↗](#)

Energy Futures – State-level adoption saves money and lives.

Modeling Systems

Our state-of-the-art models and analytical methods project global changes and potential risks under different policy scenarios

**Individual climate models may not provide the complete picture** [↗](#)

Climate sensitivity to changes in atmospheric CO₂ may be underestimated in individual climate models

Equilibrium climate sensitivity—how sensitive the Earth's climate is to changes in atmospheric carbon dioxide—may be underestimated in individual climate models, a team of climate scientists reports in the journal *Geophysical Research Letters*. If the internal climate variability is wrong, then the probabilistic estimates will be wrong and climate predictions could miss the mark.

New Research Projects**Toward Resilient Energy Infrastructure: Understanding the Climate Average Changes and Extreme Events in the Northeastern U.S.**

Sponsor: National Grid

Project Leader: Sergey Paltsev

Duration: 1 year

Understanding the likely extent of changes in regional energy demand due to climate change is critical to the strategic planning of energy supply and infrastructure, urban infrastructure development, and resilience of energy grid companies to physical and transition risks. While it is important to know the immediate effects of changes in climate and extremes on regional energy infrastructure and demand, it is equally important to understand these changes in longer time scales (mid- to end-of-century) to make better investment choices that withstand the effects of a changing climate. This project will study changes in the mean and extreme climate over the Northeastern United States to support strategic planning and infrastructure maintenance. The project will assess mean and extreme temperature changes, develop pathways to incorporate mean and extreme temperature changes in energy forecasting, and assess changing icing and wind speeds with climate change.

Climate Risks for Key Crops over Bangladesh (Pilot Project)

Sponsor: MIT Lincoln Laboratory

Project Leader: Adam Schlosser

Duration: 6 months

Climate change poses salient risks for crops worldwide, with developing countries such as Bangladesh particularly vulnerable. For much of the tropical-to-temperate areas over southern and eastern Asia, climate variability, seasonal-to-diurnal cycles, weather extremes, and their potential changes represent a growing risk to productivity and resiliency. This project will use existing econometric emulators of yield response in key crops and an ensemble of downscaled climate projections to provide mid-century projections of crop-yield impacts over Bangladesh at high spatial granularity (about 10 kilometers). These simulations will form the basis for a description of workflow toward a national socio-economic model framework that would ultimately provide the computational capability to explore and assess impacts, adaptation and resiliency strategies. The project will produce a set of crop-risk profiles, and results from its climate and crop simulations (to be documented in a report) will form the basis for how crop impacts can be vetted through a regional economic model framework.

Joint Program Reports

- 338.** Deep Decarbonization of the U.S. Electricity Sector: Is There a Role for Nuclear Power?
- 339.** MIT Scenarios for Assessing Climate-Related Financial Risk
- 340.** Can a growing world be fed when the climate is changing?
- 341.** Emulation of Community Land Model Version 5 (CLM5) to Quantify Sensitivity of Soil Moisture to Uncertain Parameters

Joint Program Reprints

- 2018-23.** Quantifying coal power plant responses to tighter SO₂ emissions standards in China (*PNAS*)
- 2019-7.** Health Co-Benefits of Sub-National Renewable Energy Policy in the U.S. (*Environ Res Lett*)
- 2019-8.** The Economic, Energy and Emissions Impacts of Climate Policy in South Korea (*Clim Change Econ*)
- 2019-9.** Evaluating India's climate targets: the implications of economy-wide and sector specific policies (*Clim Change Econ*)
- 2019-10.** Co-benefits of China's climate policy for air quality and human health in China and transboundary regions in 2030 (*Environ Res Lett*)

2019-11. Challenges for the recovery of the ozone layer (*Nature Geoscience*)

2019-12. Impacts of China's emissions trading schemes on deployment of power generation with carbon capture and storage (*Energy Economics*)

Peer-Reviewed Studies & Pending Reprints

- Bottom-Up Estimates of Coal Mine Methane Emissions in China: A Gridded Inventory, Emission Factors, and Trends (*Environ Sci Technol Lett*)
- Changes in HCFC Emissions in China During 2011–2017 (*Geophys Res Lett*)
- China's Hydrofluorocarbon Emissions for 2011–2017 Inferred from Atmospheric Measurements (*Environ Sci Technol*)
- Considering the role of adaptive evolution in models of the ocean and climate system (*J Adv Model Earth Sys*)
- Dimensions of marine phytoplankton diversity (*Biogeosciences*)
- Future Harmful Algal Bloom Science: Directions and Challenges in a Changing Climate (*Harmful Algae*)
- Greener and Fairer: A Progressive Environmental Tax Reform for Spain (*Econ Energy Environ Pol*)
- Increase in global emissions of HFC-23 despite near-total expected reductions (*Nature Communications*)

Lost [and found] in Transition: Expert stakeholder insights on low-carbon energy transitions in Spain (*Energy Res Soc Sci*)

Marginal climate and air quality costs of aviation emissions (*Environ Res Lett*)

Mercury Benefits of Climate Policy in China: Addressing the Paris Agreement and the Minamata Convention Simultaneously (*Environ Sci Technol*)

Microbial feedbacks optimize ocean iron availability (*PNAS*)

Premature mortality related to United States cross-state air pollution (*Nature*)

Projecting Energy and Climate for the 21st Century (*Econ Energy Environ Pol*)

Seasonal and diurnal variability in O₃, black carbon, and CO measured at the Rwanda Climate Observatory (*Atmos Chem Phys*)

Statistical Emulators of Irrigated Crop Yields and Irrigation Water Requirements (*Ag Forest Meteorol*)

The economic and emissions benefits of engineered wood products in a low-carbon future (*Energy Economics*)

Underestimating Internal Variability Leads to Narrow Estimates of Climate System Properties (*Geophys Res Lett*)

Will Greenhouse Gases Mitigation Policies Abroad affect the Domestic Economy? The Case of Taiwan (*Clim Change Econ*)

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Milestones

The John D. and Catherine T. MacArthur Foundation selected [CREWSNET](#), a proactive climate resilience system co-developed by MIT and [BRAC](#), a leading development organization, as one of the highest-scoring proposals, designated as the Top 100, in its *100&Change* competition in 2020 for a single \$100 million grant to help solve one of the world's most critical social challenges. The Joint Program is a key contributor to CREWSNET. [↗](#)

MIT Sloan School of Management Assistant Professor [Valerie Karplus](#), a Joint Program faculty affiliate, is one of nine women recognized for achievements and leadership in clean energy as part of the Clean Energy Education & Empowerment Initiative. She received the Education award in recognition of her outstanding accomplishments as a professor and mentor. [↗](#)

MIT EAPS/IDSS Associate Professor and Joint Program faculty affiliate [Noelle Selin](#)'s research on "Mercury Pollution and Human-Technical-Environmental Interactions in Artisanal Mining" is one of 16 projects recently funded by the NSF's "Dynamics of Integrated Socio-Environmental Systems" (CNH2) program. [↗](#)

MIT EAPS Professor and Joint Program faculty affiliate [Kerry Emanuel](#) won the BBVA Foundation Frontiers of Knowledge Award in Climate Change for detecting and predicting the intensification of hurricanes as a consequence of global warming. [↗](#)

The annual "Global Go-To Think Tank Index Report" ranked the MIT Center for Energy and Environmental Policy Research ([CEEPR](#), one of the two parent centers of the Joint Program) seventh globally and third in the U.S. in the "Energy and Resource Policy Think Tanks" category. [↗](#)



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Massachusetts Institute of Technology
77 Massachusetts Ave., E19-411
Cambridge, MA 02139 USA

T (617) 253-7492 F (617) 253-9845
globalchange@mit.edu
<http://globalchange.mit.edu>

