



ENERGY POLICY INSTITUTE
AT THE UNIVERSITY OF CHICAGO



Discover.
Impact.
Educate.

THE GLOBAL ENERGY CHALLENGE

Energy powers our modern world, fueling innovation and improving living standards across the globe. But delivering reliable and affordable energy, while limiting its environmental and social damages, is one of society's greatest and most complex challenges.





EPIC Director Michael Greenstone speaking at the Discover UChicago event in London, May 2015.

THIS IS THE GLOBAL ENERGY CHALLENGE

How can we ensure that energy markets provide people around the world, today and in the future, with access to the reliable, affordable energy needed for human development without putting our health, environment and climate at risk?

Throughout history, access to energy has been critical for economic growth. This trend is expected to continue in the years to come—global energy demand is set to grow by almost 30 percent over the next two decades. All of this growth will occur in emerging economies where 1.2 billion people currently lack access to reliable electricity, and more than half of it will occur in China and India alone.

Yet, for all of its benefits, today's energy system comes with significant social costs. A changing climate is beginning to affect our lives in profound ways. High pollution levels are shortening lifespans, especially in emerging economies. And all of these impacts can hold back economic progress, often in areas where people are living on low incomes.

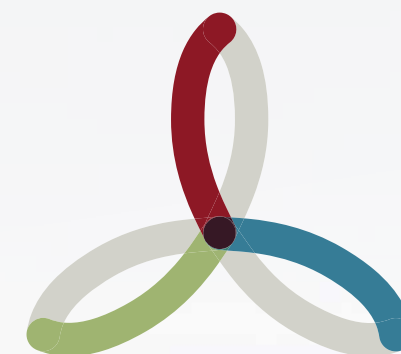
EPIC is confronting this challenge by uncovering the true costs of our energy choices so that decision makers are informed and policies and technologies take account of the ways in which human behavior and social norms influence the energy system. Because the complexity of the energy challenge requires an interdisciplinary approach, EPIC acts as a hub for energy and environmental research that links the University of Chicago's renowned social scientists with leading thinkers at the Harris School of Public Policy and the Law School, the innovative business minds at the Booth School of Business, the data scientists at the Computation Institute, and the engineers and natural scientists throughout the University such as at the Institute for Molecular Engineering and at the Argonne National Laboratory.

By leveraging these world-class minds with a wide variety of expertise, and following in the University of Chicago tradition of inquiry and impact, EPIC researchers are bringing unrivaled analytical capacity to bear in addressing the global energy challenge. Simply put, we follow the data to discover solutions. At the same time, the Institute is working directly with global leaders to help them make important decisions that will impact our future, while also educating and mentoring the energy leaders of tomorrow.

CONFRONTING THE GLOBAL ENERGY CHALLENGE

The Energy Policy Institute at the University of Chicago (EPIC) is confronting the energy challenge using a unique, interdisciplinary approach that translates cutting-edge research into real-world impacts through strategic outreach and training for the next generation of global energy leaders.

AREAS OF FOCUS



Energy Markets

With our energy system rapidly changing, an adaptive market structure, appropriate prices and incentives, and supportive public policy are needed to ensure access to secure and reliable energy worldwide.

Climate Change

As communities and businesses globally endure the impacts of climate change, a deeper understanding of the science and efficient set of policies are needed to reduce emissions while maintaining growth.

Environment

Because pollution from fossil energy hurts human health and holds back progress, improved technologies and data-driven policies are needed to ensure energy drives our modern society without damaging it.

Discover

By combining the insights of economists, policy analysts, and business experts with the technical expertise of engineers and scientists, EPIC's broad mix of faculty affiliates work together to bring robust, interdisciplinary research to the forefront of solving the global energy challenge. This research is organized by eight strategic themes that cut across multiple disciplines and global regions.



Markets & Prices

Energy markets are key to matching supply with demand, influencing how industry decides to produce and distribute energy and how consumers decide how to buy and use it. Well-functioning markets increase energy access while improving reliability and affordability.

KEY QUESTIONS

What are the most effective ways to structure markets so that energy prices reflect environmental and climate damages?

How does energy price volatility impact the economy and energy systems both locally and globally?

What role can market signals play in expanding energy access in emerging market economies?

RESEARCH IN ACTION

Developing India's First Emissions Trading Scheme

EPIC-India researchers are working with the Indian central government and several Indian state governments to implement India's first emissions trading scheme for particulate matter, the deadliest form of air pollution. This scalable pilot project will drastically reduce air pollution at a low cost to both government and industry and provide a successful case study for other regions to follow.



Climate

Climate change is considered by many to be today's most urgent, global challenge. The impacts of climate change are already emerging in more damaging storms, extreme temperature changes, agricultural changes, and depleting water supplies that together affect households, businesses and communities around the world. A deep, evidence-based understanding of the present and future impacts of climate change is essential to implementing policies that reduce the risks.

KEY QUESTIONS

What are the impacts of climate change in the U.S. and around the world?

How do we quantify the costs of climate change?

What policies can reduce emissions in the most cost effective manner?

ENERGY ON THE ROAD

UChicago at the World Economic Forum: The Future of Energy and Climate Change in Emerging Economies

Top business leaders who were gathered for the 2015 World Economic Forum came together for an EPIC-led discussion on climate change in emerging economies. The event included the former director of the White House Office of Energy and Climate Change Policy Carol Browner, the CEO of the World Bank's International Finance Corporation Jin-Yong Cai, and a member of the Indian Parliament Jairam Ramesh.



Environment

Fossil energy continues to be critical for the development of a vibrant, modern society. Yet, these fuels can release harmful toxins into our air and water, with proven, negative impacts for human health. Innovators can bring new technologies to bear to address these challenges, and social scientists can help bridge the gap between the cost-effective technologies in place today and improved environmental outcomes through data-driven policy and market analysis.

KEY QUESTIONS

How can countries get access to the energy they need without undermining the health of their citizens?

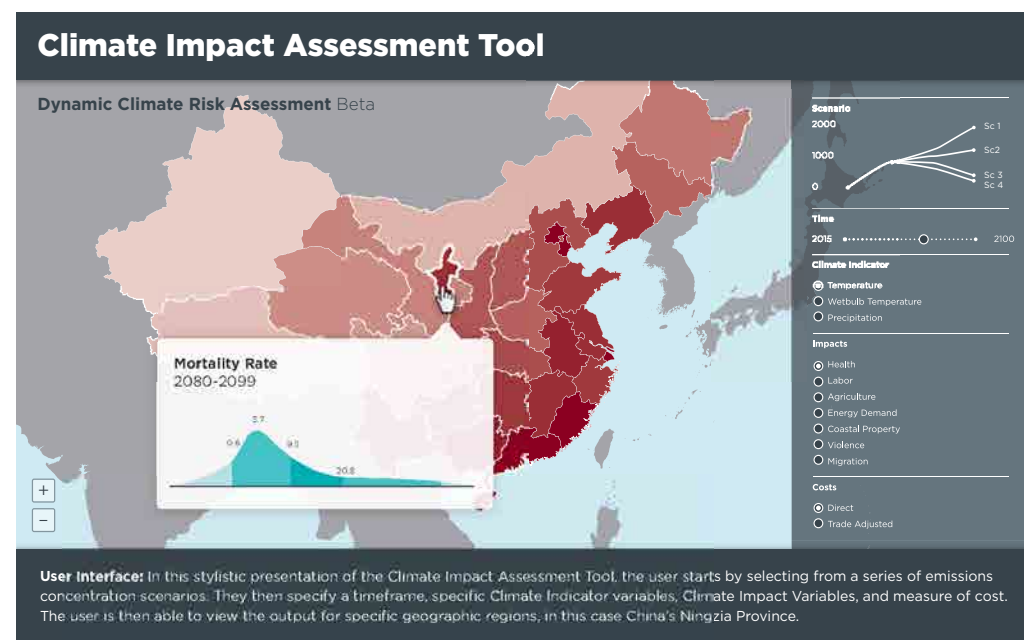
How can the social and health impacts of pollution be measured and factored into policymaking?

What are the low-cost policy options that are politically feasible?

IN THE NEWS

NY Times: Pollution Leads to Drop in Life Span in Northern China, Research Finds

A study by EPIC's Michael Greenstone found that pollution in northern China is cutting lifespans short by five years. The study received significant media coverage from nearly every major international and Chinese outlet, helping to create a public outcry in China that drew the attention of the environment ministry and spurred the declaration of a "war on pollution."



The Global Social Cost of Carbon Project

The expected impacts of climate change are already affecting communities around the world. As these challenges continue, business leaders, insurance advisors, policymakers, and other stakeholders need to make important decisions about how to adapt today and reduce future emissions. However, two critical problems have prevented decision makers from taking effective action: a poor understanding of the very real dangers that a changing climate will pose to investments, infrastructure and populations; and the lack of a clear monetary value of damages from the carbon pollution that is warming our planet.

The Global Social Cost of Carbon Project is addressing these challenges by bringing together some of the nation's leading economists, climate scientists and computational experts to estimate climate damages using real-world data and to assess the impacts to specific sectors in specific regions throughout the world. These projections will be made publicly accessible through a novel, web-based Climate Impact Assessment Tool. This first-of-its-kind platform will instantly update to reflect the latest high-quality information as research progresses so that leaders always have access to the best information.

The Project will also aggregate climate damages to construct the world's first empirically-derived single global figure for the cost of emitting one ton of carbon into the atmosphere: the Global Social Cost of Carbon. This figure will provide not only critical information on the costs and benefits of certain actions, but also a needed guidepost that can be fed directly into energy and climate policies and business decisions.



Law & Regulation

The energy industry is among the most heavily regulated of industries globally. Properly designed and implemented, regulations can be cost-effective and efficient. Yet, governmental agencies in both developed and developing economies face a myriad of challenges when regulating the energy industry, including enforcement costs and balancing competing social objectives such as service reliability, cost and environmental impacts.

KEY QUESTIONS

How can regulatory systems maximize compliance while minimizing costs and reliability?

What are the most effective legal and regulatory frameworks globally?

Can they be replicated in other countries?

BEYOND THE CLASSROOM

Law Students Guide Policymakers on the Key Legal Issues Within the Clean Power Plan

Through the Abrams Environmental Law Clinic at the University of Chicago Law School, students help communities tackle the environmental problems they are facing today. As part of that work, the students are putting together state-by-state and issue-by-issue guides to help lawmakers and industry experts navigate key legal questions within the Clean Power Plan.



Energy Resources

Global energy production is in the midst of historic shifts. Improved extraction techniques have unlocked massive oil and natural gas resources. Meanwhile, the costs for renewable energy are declining, leading to a rapid growth in cleaner energy worldwide. As new sources of energy supply become available and competitive, a more complete picture of the benefits and costs of these resources would lead to more efficient policies.

KEY QUESTIONS

What role will conventional energy play as we move forward?

What is the potential of renewable energy around the world?

What have we learned from the pace of innovation in the U.S. that could be applied to new technologies or to new regions of the globe?

FROM THE TOOLBOX

Nuclear Cost Calculator Provides Policymakers with Decision-Making Tool Based in Hard Evidence

Over the last two years, EPIC's Bob Rosner has developed an online interface that provides a nuanced look at the economic costs of nuclear power. The tool promises to root discussions about nuclear energy in hard evidence. But beyond simply breaking down costs, the model provides an economic rationale against practices that could raise the risk of nuclear materials landing in the wrong hands.



Grid & Storage

New technologies and policies are rapidly accelerating changes in the power sector. But the continued growth in intermittent electricity sources such as wind and solar will ultimately hinge on access to cost-effective energy storage. The combination of distributed generation and affordable storage—whether attached to a solar panel on a home or onboard a plug-in electric vehicle—is broadening what it means to be an energy consumer and changing the way utilities must do business.

KEY QUESTIONS

What is the future of the electricity grid in an era of renewables and decentralization?

What new business models and regulations will emerge?

What role will storage play, and how can we accelerate it?

PARTNER SPOTLIGHT

Bringing Technologies to Market

The world's most advanced energy storage research is taking place at Argonne National Laboratory. To ensure that it has an impact on our daily lives, Argonne recently launched ACCESS—the Argonne Collaborative Center for Energy Storage Science—a powerful collaborative of scientists and engineers from across the lab dedicated to helping public and private-sector customers turn research into solutions.



JCESR: Developing the Next Generation of Batteries

EPIC's research is enhanced by our partnership with the Department of Energy's Argonne National Laboratory. In relation to our Grid and Storage and Transportation research, this partnership becomes especially valuable when working with the Argonne led Joint Center for Energy Storage Research (JCESR), which is developing next generation, beyond lithium-ion batteries. JCESR's team of government, academic and industrial researchers integrate discovery science, battery design, research prototyping and manufacturing collaboration in a single highly interactive organization. Its vision is to transform transportation and the electricity grid with high performance, inexpensive electricity storage that enables widespread deployment of electric cars, broad penetration of wind and solar electricity and breaks the century-old constraint of matching instantaneous electricity generation to an ever-changing demand.



Energy Efficiency

Each year, a significant amount of energy is wasted in power plants, on the road, and in our homes and businesses. Finding ways to cut energy use in efficient ways is often touted as a win-win-win, promising to reduce pollution that harms our health, cut greenhouse gas emissions that cause climate change, and save us money. Energy efficiency does offer significant promise. But some energy efficiency programs have been shown to underperform in practice.

KEY QUESTIONS

How can we reduce the costs and impacts of delivering energy?

Are energy efficiency programs delivering the biggest bang for the buck?

What policies are needed to ensure that efficiency programs reach their potential?

PROGRESS ON POLICY

Study Informs Policy to Improve Energy Efficiency Measurement

In a first-of-its-kind evaluation of federal residential energy efficiency investments, EPIC researchers found that projected energy savings were more than double actual savings. The study—covered by nearly every major U.S. media outlet, including the *New York Times* and *Associated Press*—recommends that programs be rigorously evaluated before further investments are made. Subsequently, the U.S. Clean Power Plan contained newly-added language requiring such evaluations.



Transportation

Transportation is central to our modern, interconnected world. It also is a major source of energy use, roughly equal to the energy consumed by industry and buildings. Yet unlike these sectors, which often rely on diverse fuel sources, transportation has relied predominantly on oil. While for the first time in more than 100 years new technologies are changing the ways we power transportation, significant uncertainties remain.

KEY QUESTIONS

What are the most effective market and policy tools needed to allow these technologies to compete on a level playing field?

What innovations will drive change?

How can emerging markets balance expanding mobility with the need to reduce emissions?

AROUND CAMPUS

Energy Policy Lab Explores Alternative Transportation Fuels

This Booth School of Business class taught by EPIC's Bob Topel allows students to work together to study the viability of various alternative fuels in transportation, as well as the role of policy in promoting these alternatives. Their resulting white paper then becomes a part of the EPIC publication series.

Research Spotlights



How much are people in developing countries who are suffering from severe air pollution willing to pay for clean air?

Harris Assistant Professor Koichiro Ito is working to answer this question by estimating demand for air purifiers in different Chinese cities with varying levels of pollution. He's also beginning to explore the economics of solar subsidy policies.

How did oil companies learn how to use hydraulic fracturing technology?

Booth Assistant Professor Thomas Covert is studying the role of state-mandated public disclosure of fracking operations in helping oil companies make more effective technology decisions.



How will weather patterns and variability change as climate warms in the future?

Atmospheric scientist Liz Moyer is working to understand potential climate changes under rising CO₂ levels and their impact on human societies.

Impact

EPIC leverages the insight and innovation its research fosters by working proactively to drive real-world results. EPIC faculty and researchers engage with global and national leaders, industry and local decision-makers to determine the obstacles that most urgently need to be overcome, and work with these stakeholders to test solutions to ensure they are effective, replicable and scalable. EPIC then aggressively promotes its work to the media and other policymakers and stakeholders, assuring that our ideas become part of the global energy solution.



QUARTZ

Chart of the Year—The Rising Toll of Cyclones: Catastrophic Costs, Natural And Financial



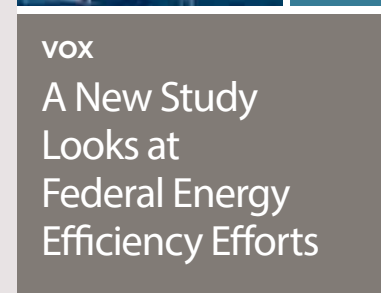
ECONOMIST

The Air That Indians Breathe Is Dangerously Toxic



WALL STREET JOURNAL

Should There Be a Price on Carbon?



VOX

A New Study Looks at Federal Energy Efficiency Efforts



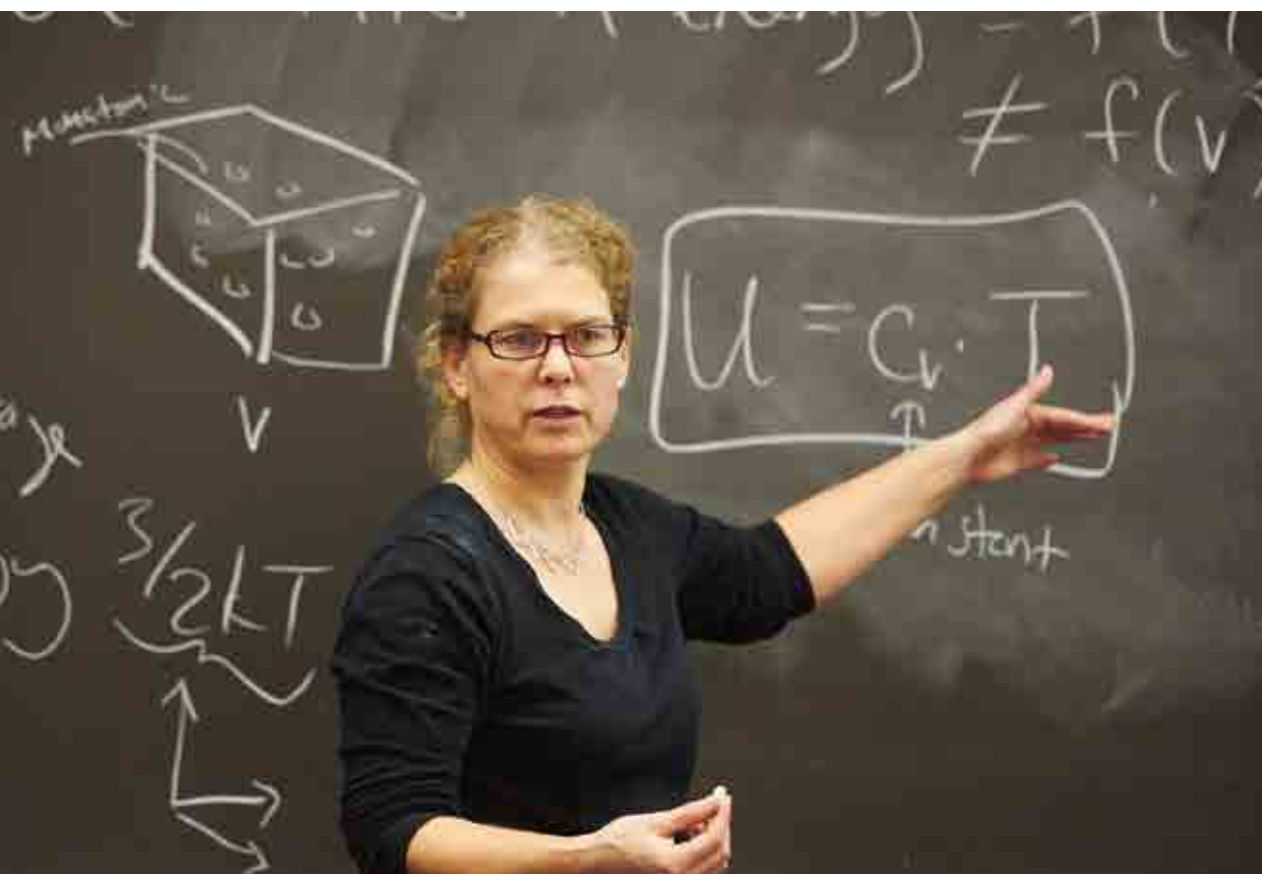
NEW YORK TIMES UPSHOT BLOG

If We Dig Out All Our Fossil Fuels, Here's How Hot We Can Expect It to Get



Educate

Because of the complexity of the energy challenge, the energy leaders of tomorrow need to develop a diverse skillset and well-rounded understanding of the energy system. As such, EPIC plays a vital role in training the next generation of global policymakers, investors and business leaders to think critically and comprehensively about energy issues and to develop and recognize solutions that work.



Associate Professor of Atmospheric Science Elizabeth Moyer teaches her Climate Foundations class.

Climate Impacts Summer Session

As part of a larger effort across multiple universities to quantify the impacts of climate change on communities, EPIC and the University of California at Berkeley held a three-month intensive workshop to graduate students from across the country in economics, business, agriculture and natural resources, and sustainable development. The scale and scope of the workshop was unprecedented in the social sciences, as it represented a group of nearly 30 people contributing to a single mission. The students were taught cutting-edge research methods in interdisciplinary climate economics, and formed their own research projects that promise to lead to publications on the impacts of climate change on various sectors of the economy.

Energy Coursework. Through an online portal, students are able to learn about the many energy and environmental classes offered at the University by our faculty affiliates, educating a whole new generation on these topics.

Internships. EPIC offers internship opportunities to University of Chicago students, including opportunities in other countries such as India and—through partner organizations—China. These opportunities engage students in the real-world learning and relationship building that is critical to succeed in today's energy sector.

PhD Research Offerings. PhD students from the University have the opportunity to be sponsored by EPIC through a competitive process. This helps to draw exceptional minds to study energy and environmental topics, building the ranks of future energy leaders.

Energy Clubs. EPIC acts as a gathering place for the University's many energy and environmental student organizations. In offering opportunities for cross-club interaction and collaboration, EPIC allows students to see the value in learning outside one's own domain of knowledge.

Fellowships and Research Assistant Positions.

Students at the University, as well as recent graduates, have the opportunity to put their skills to the test through fellowship and research assistant positions with EPIC. These opportunities allow young people to engage in deep analytical research, as well as learn how to better communicate this research to decision-makers.

Weekly Workshops. EPIC hosts weekly workshops that bring together faculty affiliates from across campus in various disciplines. These workshops are an opportunity for the faculty to learn about research outside of their own domains and find areas that intersect with their research to make the research more robust.

Seminar Series. EPIC host a monthly speaker series that brings experts from throughout the nation and world to the University of Chicago to present cutting-edge research and trends. These economists, scientists and engineers work in academia, industry and government. Their expertise runs wide and deep, and serves to both inform and engage.



Global Presence: EPIC-India

The energy challenge, fueled by a need to improve energy access and reliability while limiting environmental and social damages, is perhaps most urgent in emerging economies. EPIC is committed to leading and conducting research in these regions and countries of the world that are at the center of this challenge.

To this end, in 2014 EPIC launched its first regional hub in India, with fulltime research staff based in the University of Chicago's Delhi Center. EPIC-India is conducting cutting-edge research to test new approaches for expanding energy access and achieving low-cost reductions in pollution. Through partnerships with India's Central, State and local governments and industry, researchers work directly with decision-makers, often from the inception of a research project, to ensure results are translated into real-world actions. These innovative collaborations are already successfully identifying solutions and making their way into India's policies. EPIC is working to establish a center in China that would replicate the design and purpose of the center in India, and hopes to establish other centers as research interests and opportunities arise.

CASE STUDY

An Experiment to Improve Environmental Regulation in Gujarat, India

Gujarat is the most industrialized state in India and among its most heavily polluted. The Gujarat Pollution Control Board regulates more than 20,000 industrial plants using third-party audits; firms would choose and pay their auditors directly, and there was no mechanism to scrutinize the quality of auditors' reports. As a result, auditors that reported the truth were unlikely to be hired, especially by highly polluting firms that did not wish to be noticed. Neither the Gujarat environmental regulators nor the auditors themselves thought the status quo system was producing accurate information about pollution. For the regulators, this meant they were unwilling to take action based on audit reports.

The Gujarat authorities partnered with EPIC researchers and collaborators to answer a simple question: Does adjusting incentives to break the conflict of interest lead to more truthful auditing, and thus, less pollution? The EPIC team tested a series of reforms that gave auditors of polluting plants the incentives to tell the truth, including randomly assigning

auditors to industrial plants and having their work double-checked for accuracy. The reforms led to more accurate reporting, and reduced pollution by 28 percent.

Through a strategic outreach campaign to spread the word about the success of the tested reforms, the team wrote a policy brief sent to targeted opinion leaders and influencers, penned an op-ed that appeared in the *New York Times*, and received coverage from national and international media such as the *Wall Street Journal*. In January 2015, the pilot reforms were officially adopted by the Gujarat government. Building off this early progress, the researchers are now working with Indian states to pilot a particulate matter emissions trading program, among other projects.

“Our partnership proves the success of innovative, evidence-based approaches to policymaking and is a model for how researchers and policymakers can make a big difference by working together.”

HARDIK SHAH, MEMBER SECRETARY OF THE GUJARAT POLLUTION CONTROL BOARD

CASE STUDY

High Pollution Cuts Most Indian Lives Short by Three Years

In a study of India's pollution, EPIC researchers found compliance with Indian air quality standards would save millions of lives. Through an aggressive outreach campaign, the findings received coverage in almost every major domestic and international outlet, including the *New York Times*, *International Business Times*, *The Hindu* and *Economic Times*, as well as in social media. One of the researchers appeared on India's *NDTV* to discuss the findings, and an op-ed was written in the *Indian Express* outlining the policy recommendations from the research. In addition to boosting a growing social movement calling for solutions to India's air pollution, there is evidence that the findings influenced the direction of policy. The analysis and subsequent op-ed called for a greater reliance on civil penalties to provide polluters with an incentive to reduce pollution. In May

2015, an amendment to Indian environmental law was proposed that would do just that, imposing a fine of Rs. 10 crore (GBP 1 million) for egregious violations.

The study was based off a previous study by EPIC researchers of China's pollution. In it, they were able to develop an important metric that they applied to India: every additional 100 micrograms of total suspended particulate matter per cubic meter in the atmosphere lowers life expectancy at birth by three years. The China study also received significant media coverage from nearly every major international and Chinese outlet, helping to create a public outcry in China that drew the attention of the environment ministry and spurred the declaration of a “war on pollution.”

LEADERSHIP

Michael Greenstone

Director, EPIC
Milton Friedman Professor of Economics,
Department of Economics,
Social Sciences Division

Michael Greenstone is the Milton Friedman Professor of Economics and Director of the interdisciplinary Energy Policy Institute at the University of Chicago. He previously served as the Chief Economist for President Obama’s Council of Economic Advisers and on the EPA’s Science Advisory Board. Greenstone also directed the Brookings Institution’s Hamilton Project, which studies policies to promote economic growth, and has since joined its Advisory Council. He is an elected member of the American Academy of Arts and Sciences and editor of the Journal of Political Economy. Before coming to Chicago, Greenstone was the 3M Professor of Environmental Economics at MIT.

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Victoria Ekstrom High

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