MIT JOINT PROGRAM ON THE SCIENCE AND POLICY of GLOBAL CHANGE

Global Changes

Spring 2012 | In This Issue

Discover new interactions among natural and human climate system components

Objectively assess uncertainty in economic and climate projections

Critically and quantitatively analyze environmental management and policy proposals

Improve methods to model, monitor and verify greenhouse gas emissions and climate impacts

Understand the complex connections among the many forces that will shape our future

Integrating natural and social science to further the international dialogue toward a global response to climate change

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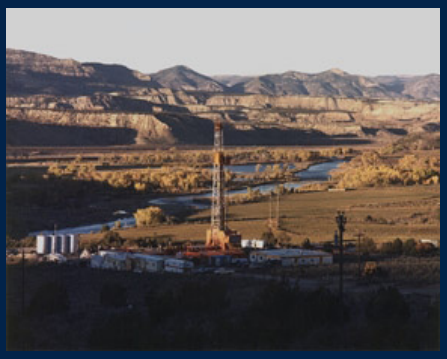

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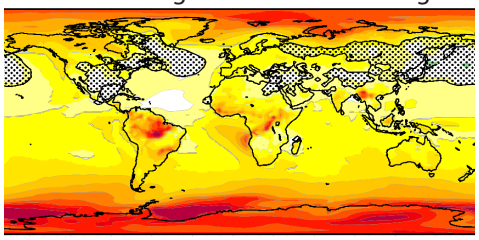
Sponsors Webinar Series

The Joint Program on the Science and Policy of Global Change continued its Sponsors Webinar Series this season with two new webinars. On November 10, 2011, Co-Director John Reilly took a look at the "Energy, Environment and Economic Outlook" in advance of the release of the Program's Outlook Report. On February 2, 2012, Dr. Adam Schlosser presented on the "Arctic/Boreal Ecosystems and Climate: What changes could we expect in this century?"

Climate Change + Land Cover Change



Source: Schlosser, 2012

For those who missed these events, they are available on the sponsors-only section of the website at: http://globalchange.mit.edu/sponsors/sponsorsonly/webinars.html.

The next webinar is expected to be in June. More information will follow in an emailed invitation. We hope you will be able to attend!

XXXIII MIT Global Change Forum

The Global Change Forum is almost here!

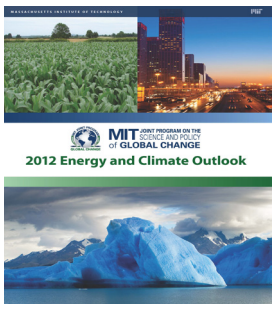
Date: March 28-30, 2012
Place: Arlington, VA
Theme: **Evaluating Progress on the Climate Front**

Forum attendance is by invitation and pre-registration only. If you haven't registered, please contact Frances Goldstein at fkg@mit.edu.

The Joint Program Welcomes Tsinghua University Students

As part of the new China Energy and Climate Project (CECP) — a collaboration with Tsinghua University in Beijing, China — the Joint Program welcomes two visitors from Tsinghua. Tianyu Qi is a Ph.D. student studying energy modelling and the international energy market. Da Zhang, also a Ph.D. student, is studying the economics of climate change using multi-region, sector and household general equilibrium models of China's economy. They will be working with the Joint Program's Dr. Valerie Karplus.

Energy and Climate Outlook



In March, 2012, the Joint Program launched its first Energy and Climate Outlook Report. Using the Program's Integrated Global Systems Model, the report makes economic, energy and climate projections from now until 2050 — and beyond. The report is available at: http://globalchange.mit.edu/Outlook2012/

The Joint Program Gets a New Communications Officer

The Program welcomed Vicki Ekstrom as Communications Officer in November 2011. Her position at MIT is a return home after spending four years working in Washington, D.C. as a national beat correspondent for the Bangor Daily News, a Press Secretary for the Senate Committee on Small Business and Entrepreneurship under Senators John Kerry (D-MA) and Mary Landrieu (D-LA), and a speechwriter for EPA Administrator Lisa Jackson. Vicki replaced Allison Crimmins, who is now a staff scientist at EPA.

Feel free to contact Vicki for any media or outreach questions or feedback at: vekstrom@mit.edu.

Our New Look is Here

After 20 years, the Joint Program on the Science and Policy of Global Change has refreshed its look with a new logo, stationary, brochure and much more!

Keep an eye out for our new logo on all of our program materials.

MIT JOINT PROGRAM SCIENCE POLICY GLOBAL CHANGE

EPA Air Chief Talks Energy, Environment with MIT Experts

An unabridged version of this article originally appeared in MIT News (2.2.2012)

Looking to tap the knowledge of some of the nation's leading energy and environment experts, the U.S. Environmental Protection Agency's top air official visited the Joint Program on Global Change.

Source: U.S. Environmental Protection Agency

Gina McCarthy, EPA's assistant administrator for the Office of Air and Radiation, led a roundtable discussion in January hosted by the Joint Program on the Science and Policy of Global Change and moderated by the Program's Co-Director John Reilly.

A return home for the Massachusetts native who spent more than 25 years working on environmental issues in the state, McCarthy said she saw the meeting as an opportunity to "learn from the experts who have been so valuable in providing the research and the science" her office needs to be successful.

Robust science, and clear cost-benefits associated with that science is critical, McCarthy said — a lesson roundtable participant and environmental economics Professor Michael Greenstone helped her realize when he was the chief economist for President Obama's Council of Economic Advisers during the first year of the administration.

Source: U.S. Environmental Protection Agency

"I think the agency has tremendously benefitted from that," McCarthy said. "Everything these people know intersects very directly with the work I've been doing for the President."

The visit came just days after President Obama's State of the Union address, where he laid out his intention to take an "all-of-the-above" approach toward America's energy future.

"In this administration we are looking for everything from commitments to renewables, that would be wind and solar, but also recognizing that coal will have a place in the mix," McCarthy said of the President's vision. "We're asking ourselves from the EPA side what that means for our upcoming rules on greenhouse gases and source performance standards for powerplants. How do you write it in a way that's consistent with the rules and still allows a place for new coal and new technologies?"

Source: U.S. Environmental Protection Agency

MIT Global Environment Initiative Proposed

An unabridged version of this article originally appeared in MIT News (12.21.2011)

By: Jennifer Chu, MIT News

A planned university-wide initiative would fuel environmental research and innovation.

As the world's population continues to expand, our natural resources will become increasingly strained. In an effort to find sustainable solutions for the planet's growing population while minimizing environmental impacts, MIT's Environmental Research Council (ERC) has put forward a detailed implementation plan to establish a Global Environmental Initiative to complement the MIT Energy Initiative (MITEI).

The interdisciplinary, faculty-led council presented the plan to the MIT community in December in a forum held at the Kirsch Auditorium in the Stata Center. Council members outlined an initiative that would bring together MIT's "core strengths" across campus to help solve the world's pressing environmental challenges.

"It's impossible to imagine a problem bigger and more compelling, or more suited to the strengths of MIT, than how to drive toward global sustainability," said MIT President Susan Hockfield in a video address to the forum. "Far too often the public conversation about the environment and climate gets mired in the discourse of blame and despair. Today, I believe MIT has an opportunity, and frankly an obligation, to help replace that stalemate with the momentum of creative, realistic, positive change."

Once launched, the Global Environment Initiative is expected to focus on cultivating six key areas of academic research throughout MIT: climate, oceans, water, ecological resilience, contamination mitigation and sustainable societies.

Dara Entekhabi, professor of civil and environmental engineering and chair of the ERC, says that while

Source: MIT News

many researchers at MIT are working in the research themes identified in the plan, often these efforts occur in isolation. For example, a biologist studying the health effects of contaminants could give valuable input to chemists designing new materials. Or a mechanical engineer designing a water purification facility may benefit from an urban planner's perspective. The environmental initiative will aim to identify and bring together such related efforts, foster technological and social innovations in all six environmental research themes, and identify strategic directions for growth.

In the areas of climate and oceans, MIT already has a strong foundation of interdisciplinary collaboration. The Center for Global Change Science, the Joint Program on the Science and Policy of Global Change, the Climate Modeling Initiative, and the recently launched Lorenz Center all focus on understanding the climate system and human contributions to that system. Going forward, the Global Environment Initiative would work to strengthen these existing efforts and identify new research priorities.

One of the initiative's first goals, once launched, will be securing funding for graduate and postdoctoral fellowships, as well as ignition grants, to foster innovative, cross-disciplinary research projects that would otherwise struggle to attract initial funding from traditional sources.

To view the plan, visit: http://web.mit.edu/provost/reports/2_ERC_Report.pdf

A Shale Gas Revolution?
Reprint 2012-1

This article originally appeared in MIT News (1.3.1012)

A new MIT report shows a prosperous shale gas market could hurt future R&D, if we let it.

Shale gas — a resource that has grown significantly in just the last few years to one-quarter of the domestic gas supply — is cheaper and involves fewer emissions than traditional coal or oil. But recent environmental concerns, combined with shale gas's important role in the global economy, have prompted the Obama administration and MIT researchers to investigate the resource and its potential impacts.

"People speak of [natural] gas as a bridge to the future, but there had better be something at the other end of the bridge," Henry Jacoby, co-director emeritus of MIT's Joint Program on the Science and Policy of Global Change, said earlier this year after co-authoring a report by the MIT Energy Initiative (MITEI) on The Future of Natural Gas.

Jacoby's nagging thoughts prompted him and other researchers to further study shale gas and how its success could impact U.S. energy policy, including future technological development. Built on the MITEI study, the researchers' new report — "The Influence of Shale Gas on U.S. Energy and Environmental Policy" — is in this month's inaugural edition of the journal Economics of Energy and Environmental Policy.

"Prior to this we hadn't compared U.S. gas production with and without shale," Jacoby says of the new research.

"This report makes that comparison. And we found much of what we already knew — which is a good thing — that shale makes a big difference. It helps lower gas prices, it stimulates the economy and it provides greater flexibility to ease the cutting of emissions. But it also suppresses renewables."

The researchers came to these conclusions by considering what our nation would look like with shale and without shale under several policy scenarios. They found that gas prices would rise by about five times the current levels by 2050 without shale gas, under one scenario; electricity prices would also grow. But with shale gas, prices should only about double. The shale input also reduces electricity price growth by 5 percent in 2030 and 10 percent in 2045, compared to a scenario without shale gas.

John Deutch, MIT professor and chair of a special U.S. Department of Energy panel studying shale, agrees with the significant economic contribution the shale industry can provide. Deutch, who was associated with the earlier MITEI report but not the new MIT study, said that the most recent employment estimates showed that there are three-quarters of a million jobs in the shale gas industry.

"More jobs are being created in Pennsylvania and Ohio by shale gas production than anything else that I'm aware of," Deutch said at a recent MIT lecture, suggesting the significance of those two battleground states in U.S. elections. "Over the last couple of years I've realized that what's happening with unconventional natural gas [shale] is the biggest energy story that's happened in the 40-plus years that I've been watching energy development in this country," says Deutch, who served as undersecretary of the Department of Energy in the 1970s.

Shale's low price tag is one of the reasons for its boom. For every $4 we pay for energy from natural gas, we pay $25 for oil, according to recent statistics from the U.S. Energy Information Administration. Jacoby and Deutch agree this is not sustainable, and that there is a great incentive to continue to tap into

the shale market — with Deutch calling shale "remarkably inexpensive" compared to other forms of natural gas. This successful outlook has prompted some of the world's leading oil companies to further invest in natural gas, and specifically shale gas production.

But Jacoby warns, "Natural gas is a finite resource. We will eventually run into depletion and higher cost." He adds, "It still releases greenhouse gas emissions. So if we're going to get to a point where we strictly limit those emissions, we need renewables."

The continued need for strong renewables prompts concerns, as the study finds that shale use suppresses the development of renewables. Under one scenario, for example, the researchers impose a renewable-fuel mandate. They find that, with shale, renewable use never goes beyond the 25 percent minimum standard they set — but when shale is removed from the market, renewables gain more ground. These findings are significant in light of several concerns surrounding the unpredictable shale gas market and future environmental regulations.

One concern about shale gas extraction, and the most headline-grabbing concern, is that fluids from the gas production — a process called hydraulic fracturing, or simply fracking — could seep into and contaminate groundwater supplies. While the report found these concerns to be "overstated," the Deutch shale panel said in November that "environmental issues need to be addressed now." This conclusion, along with uncertainties about how stringent greenhouse gas emission targets will be going forward, leaves the regulatory environment in question.

There's also the concern that the global gas market is unpredictable because the shale revolution is still in its early stages. Jacoby says the development of the industry in the United States is important because prices here are much cheaper than in other gas markets — namely, Europe and Asia. While we pay less than $4 per thousands of cubic feet, other markets pay up to $16. Because it is so much cheaper here, there's the potential for us to become exporters. But Jacoby calls this really a "matter of timing."

"In the near term, our supplies are cheap enough that we should have the ability to export," Jacoby says. "But over time, we likely won't be able to compete with places like Russia and the Middle East that have lower costs, and eventually we'll again turn to importing gas."

Jacoby compares the global gas market to the oil industry. As shale resources are developed in places such as China, which recently announced that it was tapping at least 20 new reserves, prices will likely drop overseas and the United States will turn to cheaper imports as it has for oil. An uncertain international gas market, an unpredictable regulatory environment with more stringent emission goals and decreasing natural gas reserves over time all point to the growing need to continue developing renewable technologies.

"Effective use of renewables, namely wind and solar, are still many years away," Jacoby says. "How we tap into those resources and effectively work them into our electric grid still needs to be figured out. To get us there we need a robust R&D program so we'll have renewable energies up and working effectively later in future decades when emissions regulations are stricter, and gas reserves are depleting."

Shale might provide the flexibility to meet reduction targets at lower costs today, making it a strong "bridge" in the short term to a low-carbon future. But the report concludes that we can't let the greater ease of the near term "erode efforts to prepare a landing at the other end of the bridge."

[Jacoby, H.D., F. O'Sullivan and S. Paltsev, Economics of Energy and Environmental Policy, January 2012]

Read more about Henry Jacoby's work on shale on our website: http://globalchange.mit.edu/news/

National Geographic (1.18.2012): ***"Shale Gas: A Boon That Could Stunt Alternatives, Study Says"***

National Public Radio (2.2.2012): ***"Could cheap natural gas slow growth of renewable energy?"***

Powering Our Cars, Economy and Climate Policy

Reprint 2012-2

Article originally appeared in MIT News (1.10.2012)

How much do taxes and tariffs influence energy and climate policies? A new MIT report shows their big impact.

Regional climate policies depend largely on fiscal strategies and can have spiraling effects throughout the globe, a new MIT report further proves in the January edition of the Journal of Transport Economics and Policy. The report — titled "Biofuels, Climate Policy, and the European Vehicle Fleet" — uses the European transportation system as a test case and shows the significant impact various fiscal policies can have on emission reductions.

"The effectiveness of climate policies in isolation might depend crucially on the fiscal rules and environment," says Sebastian Rausch, a co-author of the study and a research scientist at MIT's Joint Program on the Science and Policy of Global Change. "So if you want to think about effective emissions-reduction policies and climate policies you have to take into consideration their interaction with other mechanisms like taxes and tariffs."

For decades, Europeans have relied on diesel to power their cars. While better for the environment, these drivers have traditionally chosen diesel because higher taxes on gasoline make diesel the cheaper alternative.

But now, Europe is encouraging its drivers to consider greener options. The European Union has imposed a renewable fuel mandate that requires 10 percent of fuel to be based in renewable sources like biodiesel or ethanol by 2020.

Will the higher price tag that often comes with renewables cause the mandate to have a negative effect? The MIT researchers say no.

Studying the system with and without the mandate, they find that the number of drivers using diesel and biodiesel continues to increase with time because of rising oil prices and a tax system that balances out the additional expense of using renewables.

"So fueling up with biodiesel would still be 69 cents a gallon cheaper than gasoline," Rausch says, "and it has the added benefit of reducing European emissions by about 8 percent by 2030."

The report further analyzes the impact of tax or tariff changes, in combination with the imposed mandate.As one might expect, when gasoline and diesel have an equal tax rate almost a quarter fewer drivers choose diesel by 2030. The renewable fuel mandate also does not have a large impact on emissions because more drivers turn to gasoline. But if biodiesel and ethanol tariffs are removed, Europe can achieve significant emission reductions — about 45 percent — as these renewable fuels become cheaper to import and use.

At the same time, diesel vehicles would all but disappear as ethanol blends crowd out the diesel market Looking at a global scale, the report shows that while renewable initiatives can cut emissions within that country, they can also cause spikes in emissions in other countries — or what is known as "leakage."

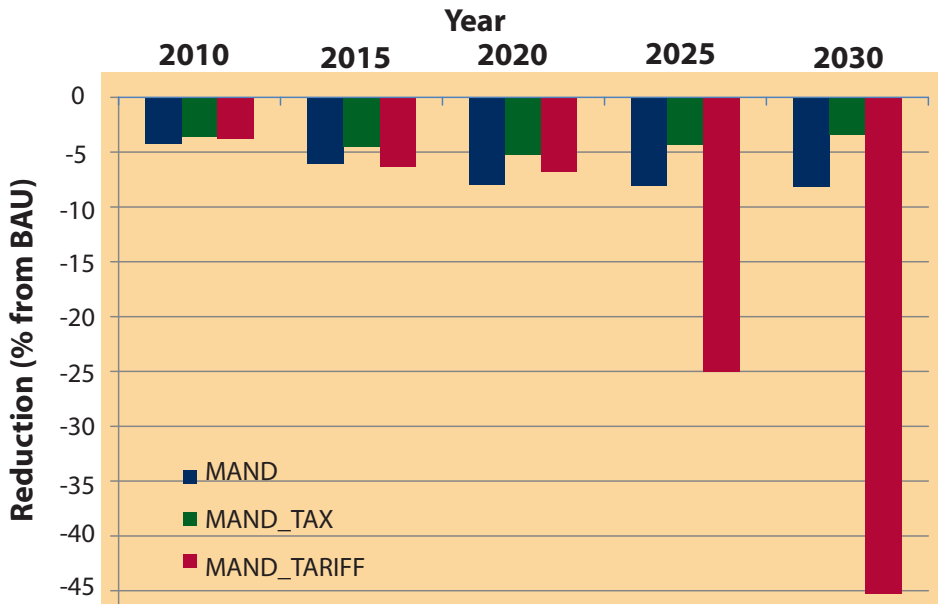
Rausch explains: "You're still driving a fair amount of diesel vehicles, but the fuel to drive those vehicles now comes from Brazil and other countries because you've removed your tariffs. You don't have to produce as much diesel in the EU, so your emissions there are little bit lower. But the countries now producing more fuel to import to the EU see higher emissions."

But there is still a positive side, Rausch says: "Because there's a switch in imports from diesel to biofuels, emissions do get reduced in other countries as well because biofuel production releases fewer emissions than diesel production."

These fuel changes in Europe can have a "snowballing effect," Rausch says. Along with "leakage," there can be other consequences. If Europe evens out its tax system, for example, increased demand for gasoline in Europe would drive up gasoline prices outside of Europe and lower gasoline consumption and emissions in general.

[Gitiaux, X., S. Paltsev, J. Reilly and S. Rausch, Journal of Transport Economics and Policy, January 2012]

Reduction of CO_2 Emissions from the Private European Transportation Sector



Source: Gitiaux, X., S. Paltsev, J. Reilly and S. Rausch. Journal of Transport Economics and Policy, January 2012

The renewable fuel mandate reduces carbon dioxide emissions by 8.2 percent (MAND) from the 2030 level. The relaxation of tariff barriers (MAND_TARIFF) on biodiesel and ethanol has a much stronger mitigation effect, reducing emissions from the European private transportation sector by 45.3 percent in 2030. The harmonization of fuel taxes (MAND_TAX) has the opposite effect, dampening slightly the mitigation effect of renewable fuel requirements. By 2030 the European fleet emits only 3.4 percent less CO_2 than in the business as usual scenario. This results from the fact that the harmonized tax rates lead to increased purchases of gasoline vehicles that have a lower efficiency.

China's Pollution Puts a Dent in its Economy

Reprint 2012-3

This article originally appeared in MIT News (2.13.2012)

Despite improvements in air quality, the economic impact of air pollution has increased dramatically, new MIT study shows.

Although China has made substantial progress in cleaning up its air pollution, a new MIT study shows that the economic impact from ozone and particulates in its air has increased dramatically.

In recent decades, China has experienced unprecedented growth. But that growth comes with a steep price tag, according to the study, which appears in the February edition of the journal Global Environmental Change. The study, by researchers at the MIT Joint Program on the Science and Policy of Global Change, analyzes the costs associated with health impacts from ozone and particulate matter, which can lead to respiratory and cardiovascular diseases.

Source: MIT News

Quantifying costs from both lost labor and the increased need for health care, the study finds that this air pollution cost the Chinese economy $112 billion in 2005. That's compared to $22 billion in such damages in 1975.

"The results clearly indicate that ozone and particulate matter have substantially impacted the Chinese economy over the past 30 years," even though there have been significant improvements in air quality detected over this period, says Noelle Selin, an assistant professor of engineering systems and atmospheric chemistry at MIT.

The researchers discovered this large economic impact because they looked at pollution's long-term effect on health, not just the immediate costs. In doing so, they found two main causes for the increase in pollution's costs: rapid urbanization in conjunction with population growth increased the number of people exposed to the pollution, and higher incomes raised the costs associated with lost productivity.

"This suggests that conventional, static methods that neglect the cumulative impact of pollution-caused welfare damage or other market distortions substantially underestimate pollution's health costs, particularly in fast-growing economies like China," says Kyung-Min Nam, one of the study's authors and a postdoc in the Joint Program on the Science and Policy of Global Change.

Nam gives one example from the study showing that pollution led to a $64 billion loss in gross domestic product in 1995. That compares to static estimates from the World Bank that found the loss to be only $34 billion.

In this way, Selin says, "this study represents a more accurate picture than previous studies."

Kelly Sims Gallagher, an associate professor of energy and environmental policy at Tufts University's Fletcher School, agrees: "This important study confirms earlier estimates of major damages to the Chinese economy from air pollution, and in fact, finds that the damages are even greater than previously thought."

The researchers calculated these long-term impacts using atmospheric modeling tools and comprehensive global economic modeling. These models proved especially important when it came to assessing the cumulative impact of ozone, which China has only recently begun to monitor. Using their models, the MIT researchers were able to simulate historical ozone levels.

China has become the world's largest emitter of mercury, carbon dioxide and other pollutants. In the 1980s, China's particulate-matter concentrations were at least 10 to 16 times higher than the World Health Organization's annual guidelines. Even after significant improvements by 2005, the concentrations were still five times higher than what is considered safe. These high levels of pollution have led to 656,000 premature deaths in China each year from ailments caused by indoor and outdoor air pollution, according to World Health Organization estimates from 2007.

"The study is evidence that more stringent air-pollution control measures may be warranted in China," Gallagher says — because of not just the health effects of pollution, but also the economic effects.

China is taking steps to respond to these health and economic concerns. In January, the nation set a target to limit its carbon intensity (the amount of carbon emitted per unit of gross domestic product) by 17 percent by 2015, compared with 2010 levels.

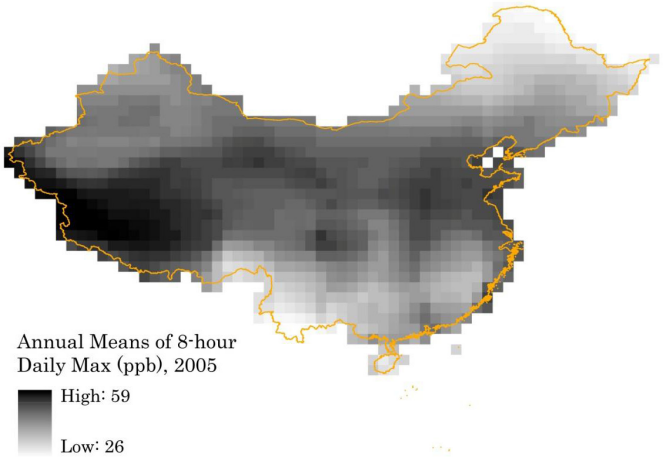
While the MIT study looked at the benefits of pollution-control measures on health in China, it did not calculate the costs of implementing such policies. That is work the Joint Program on the Science and Policy of Global Change's new China Energy and Climate Project hopes to accomplish.

"We're just getting started on an exciting program of work that will involve modeling the energy, environmental and economic impacts of climate and air-quality policies in China," says Valerie Karplus, director of the China Energy and Climate Project. "The current study has provided initial insights and a strong foundation for this research going forward."

The China Energy and Climate Project will analyze the impact of existing and proposed energy and climate policies in China on technology, energy use, the environment and economic welfare.

[Matus, K., K.-M. Nam, N.E. Selin, L.N. Lamsal, J.M. Reilly and S. Paltsev, Global Environmental Change, February 2012]

Ozone concentration levels in China, 2005



Source: Matus, K., K.-M. Nam, N.E. Selin, L.N. Lamsal, J.M. Reilly and S. Paltsev, Global Environmental Change, February 2012

Read more about our work on air pollution in China on our website: http://globalchange.mit.edu/news/

Reuters (2.16.2012): *"Worsening air pollution costs China dearly: study"*

USA Today (2.14.2012): *"MIT: China's pollution costs $112B in annual health care"*

Valerie Karplus: Designing Policies to Curb Fuel Use, GHG Emissions

An unabridged version of this article appeared in the autumn 2011 MIT Energy Initiative Magazine, Energy Futures, and was written by Nancy W. Stauffer

When it comes to cars and trucks, the most politically feasible policies in the United States today also rank among the most costly. The challenge for policymakers is to find ways to address this trade-off over time, says MIT's Valerie Karplus.

Source: Energy Futures, autumn 2011

Passenger vehicles generate about 16 percent of total greenhouse gas (GHG) emissions and consume about 40 percent of the total petroleum used in the United States — statistics that are troubling for both climate change and energy security.

For some years, the U.S. has had regulations in place to cut its growing consumption of gasoline in passenger cars. But new analysis made by Valerie Karplus, a research scientist in the MIT Joint Program on Global Change, shows that those regulations are not the most cost-effective. Nor are they the most effective in reducing gasoline use and GHG emissions.

In her analysis, Karplus looked at two types of policies for reducing gasoline use: fuel economy standards and renewable fuel standards. She found that the policies both produce comparable, relatively modest reductions in GHG emissions — 5 percent or less of total cumulative carbon dioxide emissions from fossil fuel use. They also are not the most cost-effective options.

So Karplus added a measure that specifically targets GHG emissions — an economy-wide cap-and-trade policy, which has previously been considered in U.S. legislative proposals to address climate change. She analyzed the impacts of the cap-and-trade policy alone and in combination with a fuel efficiency standard. Karplus found that combining policies may actually reduce cost-effectiveness even more, with no added reduction in emissions.

Why is this? The cap-and-trade policy is designed to elicit the least expensive GHG-reducing measures first. A fuel efficiency standard forces automakers to manufacture and sell more fuel-efficient cars — a step that is significantly more expensive than other available emissions-reducing options. The result: a higher cost to achieve the same emissions reduction.

Karplus therefore tried another policy: a moderate tax on gasoline. She found that a gas tax could elicit the same reductions as the other policies at a sixth of the cost. But using a tax to reduce gasoline demand has never proven politically feasible in the U.S. Karplus investigated why by identifying the trade-offs between the features of policies that make them cost effective and those that make them politically feasible. For example, combining energy and climate goals may mean policies appeal to broader constituencies. But combining policies that achieve these goals separately may unintentionally reduce cost-effectiveness.

"Right now, economists push for the most cost-effective measures, and the policy community responds that such measures are politically impossible," Karplus says. "We need to find ways to get past the age-old debate, starting with what is possible today but with an eye to what might be possible tomorrow as today's policies change underlying incentives."

Karplus says that policies that are politically feasible now can be designed to maximize their cost-effectiveness, and should include clear timelines for revisiting its impacts and for assessing the feasibility of moving to more cost-effective policies over time.

"That will help us achieve our critical energy security and climate goals."

Noelle Eckley Selin: US Taking Leadership on Mercury

An unabridged version of this article appeared in MIT News (1.20.2012)

Americans have long known the dangers of mercury in our environment, with doctors repeatedly warning pregnant women to remove fish from their daily diets. But despite this solid knowledge of the health impacts, the United States has never regulated mercury emissions from power plants, says Assistant Professor Noelle Selin, until now.

The Environmental Protection Agency (EPA) recently issued Mercury and Air Toxics Standards that require coal-fired powerplants to install scrubbing technology that will cut 90 percent of their mercury emissions by 2015.

To better inform local residents about the new protections, Noelle Eckley Selin — a researcher in MIT's Joint Program on Global Change — joined EPA Regional Administrator Curt Spalding and other public health experts at a public availability session in Boston.

"These mercury standards help prevent the developmental delays and neurological damages that could come from eating contaminated fish," Selin said at the Thursday, January 19, event.

At MIT, Selin looks at the pathways by which mercury reaches the environment and the effect it has on human health once it gets there. She also analyzes the steps regulators could take — and in some cases have taken — to prevent further contamination.

"There've been proposals for a long time to regulate these emissions from coal-fired powerplants," Selin said in an earlier interview with the Los Angeles Times. "The earlier incarnation of this was the Clean Air Mercury Rule, which was a cap-and-trade proposal for mercury, and that was challenged in the courts and then thrown out. And now this is another try at regulating, but it's been a long time in coming."

The air toxics standards are expected to help tens of thousands of children by preventing 30,000 cases of childhood asthma symptoms and about 6,300 fewer cases of acute bronchitis among children each year, according to EPA estimates. Vulnerable populations such as infants will also be helped specifically because of the mercury standards under the new rule.

"These will especially protect newborns who are at a greater risk during their development," Selin said. "It's estimated more than 300,000 newborns in the U.S. are exposed in utero to dangerous levels of mercury. This can cause lower IQ and neurological damages."

Source: U.S. Environmental Protection Agency

The United States' leadership in regulating mercury comes at an important time, as countries around the world have been negotiating a global, legally binding mercury treaty since June 2010.

The third of five planned United Nations negotiating sessions occurred in November (2011) in Nairobi, Kenya, and Selin plans to attend the fourth in June (2012) in Uruguay. She will also be bringing six graduate students, as part of a National Science Foundation grant, to the final negotiating session set to take place in early 2013.

In an earlier interview with MIT News, Selin said domestic politics would likely continue to be a challenge for U.S. implementation of environmental regulations and international cooperation on mercury. But with these standards — now the most stringent mercury standards of its kind in the world — she says the country has proven their leadership.

"These standards show that the U.S. is taking leadership at home to address a widespread and substantial global problem."

Quantifying Climate Feedbacks of the Terrestrial Biosphere under Thawing Permafrost Conditions in the Arctic

Project Leader: C. Adam Schlosser

This study aims to quantify the climate-warming feedback potential from emitted trace gases, as well as landscape changes within Arctic ecosystems. Analyzing these areas, we will test the hypothesis that there exists a warming threshold beyond which permafrost degradation and lake/wetland expansion will stimulate increases in methane and carbon dioxide emissions. This proposed research further improves our earth-system model by enhancing our representation of permafrost and dynamic wetland and lake systems to explore their effects on hydrological and carbon dynamics.
Source: U.S. Department of Energy

Probabilistic Climate Change Projections for Singapore and Surrounding Regions

Project Leader: Chien Wang

MIT Senior Research Scientist Chien Wang and his team received a grant to study the future climate change of Singapore and surrounding regions. Using the MIT Integrated Global System Model (IGSM) and a 3-D atmospheric and ocean general circulation mode (CESM) coupled with a size- and mixing-dependent aerosols model, among others, Wang and his team will quantify differences in factors such as convection, precipitation, cloud coverage and surface heat fluxes. The ensemble predictions made by the global climate model will be used to drive a regional climate model and a regional ocean model, and eventually a dynamically coupled global-regional climate model framework to predict the regional climate features of Singapore and surrounding areas. This work represents the first step towards coupling global and regional models, and thus accounting for the effects of both large- and local-scale influences on climate.
Source: Singapore-MIT Alliance for Research and Technology (SMART), a Singapore-based partnership of MIT and the National Research Foundation of Singapore. (http://smart.mit.edu/about-smart/about-smart.html)

The Future of Ecosystems and Extremes: Using Diverse Environmental Data Sets in Support of Regional to Global Earth-System Models and Predictions

Project Leader: C. Adam Schlosser

As a collaborative project with the Marine Biological Laboratory, Lehigh University and the University of California, Davis, we are seeking to identify regions where the resiliency to withstand extreme weather and climate events is at risk, and therefore degrade the regions' ability to resist any changes. This research will aid stakeholders and decision-makers as they prepare for and adapt to environmental change. By employing a variety of models, including MIT's Integrated Global System Model (IGSM), we will evaluate how a set of environmental stresses affects specific regions. This work will also develop a heuristic model to serve as more efficient and powerful predictive tool to help guide adaptation strategies.
Source: U.S. National Science Foundation

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