Summer/Fall 2021

HARVARD-CHINA PROJECT
on Energy, Economy and Environment

HARVARD-CHINA PROJECT NEWSLETTER

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Cover Image: Detian waterfalls in Guangxi Province, China

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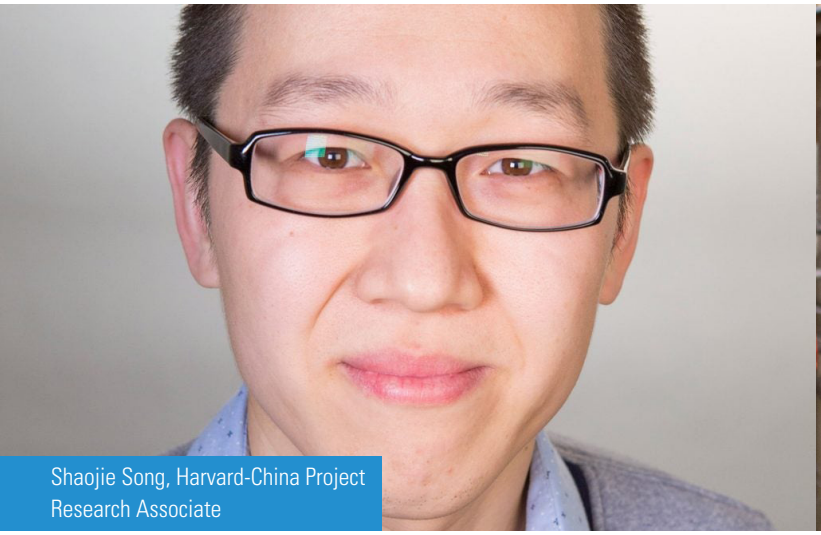


Shaojie Song, Harvard-China Project Research Associate

J. William Munger, Senior Research Fellow in Atmospheric Chemistry

HCP Team Earns Harvard's Climate Change Solutions Fund Award

Harvard faculty and students are training their interests and expertise on what is literally the world's hottest hot-button issue: global warming. As a result, nine research teams will share $1 million in the seventh round of the Climate Change Solutions Fund (CCSF) awards for proposals that create critical knowledge, propel novel ideas, and lead toward solutions that can be applied at Harvard and across the globe.

"Pursuing a more sustainable future means advancing on several fronts to address the tremendous challenges posed by climate change," Harvard President Larry Bacow said. "The projects being funded this year draw on strengths from across the University and among a wide swath of researchers and scholars. I look forward to seeing where their efforts lead us in the years ahead."

The fund was established in 2014 by President Emerita Drew Faust to support research and policy initiatives to reduce the risks of climate change, among other goals.

Harvard-China Project Award: Using In Situ Observations to Identify Methane Sources in the Beijing Region

Human activities concentrated in cities are dominant sources of carbon dioxide and methane, the greenhouse gases that affect climate. Urban areas account for 70 percent of Earth's greenhouse gases, but knowing exactly where emissions come from is essential for developing effective and affordable management plans. This project, under the direction of co-investigators **Song Shaojie**,

Research Associate, Harvard-China Project and **J. William Munger**, Senior Research Fellow in Atmospheric Chemistry, Harvard John A. Paulson School of Engineering and Applied Sciences, will use atmospheric measurements (see image of HCP atmospheric research station, left) to assess methane sources in the Beijing region, where government policy mandated a shift from coal to natural gas in district heating plants and building boilers. The goal of the project, a collaboration between the Harvard-China Project and the Tsinghua University School of Environment, is to determine whether the coal-to-gas conversion has had its intended effect on greenhouse gas reduction or inadvertently created a new greenhouse gas source. The work will prepare the team for future research on poorly understood dimensions of the second-most-powerful greenhouse gas emissions in China and identifying effective and affordable mitigation solutions.

By Erin Tighe, Office for Sustainability

New Award for Clean Hydrogen Research

In recent years, the importance of clean hydrogen in the future energy transition and low-carbon economic development has been increasingly recognized. The Ningxia Yanbao Charitable Foundation recently awarded the Harvard-China Project a grant for comprehensive research on the prospects for clean hydrogen, especially "green" hydrogen produced from water with renewable power, in China's energy and industrial sectors and as an export commodity. The project team—comprised of researchers from Harvard and collaborators at Tsinghua University and other Chinese universities—will develop comprehensive energy system optimization models for evaluating production, storage, transport, and consumption of clean hydrogen in line with China's 2060 carbon-neutral goal, at regional and national scales. The work will consider especially the technical and economic prospects for hydrogen-based decarbonization of "hard-to-abate" sectors, presented not only in peer-reviewed research publications but also in reports summarizing findings for decision-makers.

RESEARCH HIGHLIGHT

Project Economists Explore Effectiveness of China's Pilot Carbon Markets on Reducing CO_2 Using Firm-Level Evidence

When China, the world's largest emitter of greenhouse gases, launched its first national emissions-trading scheme (ETS) for the electricity sector in mid-July, it did so with the goal of achieving net-zero CO_2 emissions by 2060.

China's ETS is not a cap-and-trade system like most other ETSs around the world, because it does not impose a cap on total CO_2 emissions. It is more accurately understood as a tradable performance standard.

Under the system, companies are incentivized to reduce the intensity of their carbon emissions by a system of government-allocated emission allowances that can be bought and sold, ultimately raising costs to inefficient, high-emitting producers while rewarding efficient, low-emitting ones. The freely allocated allowances act as output subsidies to emitters. The ETS is designed to minimize the cost of emission reductions for the sector as a whole.

Now, a team of economists from Harvard University, Tsinghua University, and Beihang University have explored the effectiveness of China's pilot carbon markets—operated in seven regions since 2013 to lay groundwork for the national program—in reducing emissions in the electricity sector.

Using firm-level evidence, their research, published in the *Journal of Public Economics*, shows that while coal use in power plants in the pilot areas fell and there was a shift from less efficient to more efficient plants, these were unlikely due to the market incentives directly from the rising carbon prices.

This result highlights the challenges of implementing carbon trading in a highly regulated sector such as power generation in China, compared to the more market-driven ones slated for future phases of the national ETS, such as iron & steel production.

"As the largest carbon-emitting industry in the world, the electricity sector is an obvious target for an emission reduction policy," explains Mun S. Ho, co-author and Research Associate with the Harvard-China Project on Energy, Economy and Environment at Harvard University. "But power sectors are often highly regulated, as is the case in China, which can limit the effectiveness of a market-based emission control policy."

"We set out to explore whether the pilot markets led to a reduction in CO_2 emission intensity or total emissions, capitalizing on unique firm-level data to conduct our analysis," says co-author Cao Jing, of the Tsinghua University School of Economics and Management.

"The electricity sector is an obvious target for an emission reduction policy...but are often highly unregulated, which can limit the effectiveness of a market-based emission control policy."

The micro-level dataset encompassed nearly all power plants in China including very small ones, totaling over 10,000 both within and outside of the pilot regions. This allowed the authors to compare ETS and non-ETS plants.

The new national ETS covers roughly 2,200 of the largest coal- and natural gas-fired power plants, emitting approximately 4 billion metric tons of CO_2 annually.

Although the research shows that the pilot ETS did not raise the coal efficiency (grams of coal per kWh) of regulated coal-fired power plants during the study period, the authors did find significant reductions in electricity output and coal consumption associated with ETS participation.

"In such a highly-regulated industry, the ETS operates differently from an unregulated, marketized one," explains Ma Rong, an alumnus of the Harvard-China Project. In some countries there are spot markets where generators bid to sell their electricity, but there were none in China during the period. "The prices that generators receive are regulated. Since the cost of the emission allowances are very small relative to both the cost of coal and the regulated electricity prices, the changes in power output of each plant were likely driven by government dispatch decisions and not by profit-maximizing decisions."

In another notable finding, the study, co-authored also by Teng Fei of Tsinghua University, found no evidence that China's ETS pilots induced carbon emission leakage to other regions, possibly due to the strict regulatory hierarchy of the electricity sector. And the study did find a significant increase in the production of non-coal-fired power plants in the ETS pilot regions, compensating for the reduction in coal plant output.

By Kellie Nault and Chris Nielsen

Paper cited: Jing Cao, Mun S. Ho, Rong Ma, and Fei Teng. 2021. "When carbon emission trading meets a regulated industry: Evidence from the electricity sector of China." Journal for Public Economics, 200, August, 104470.

RESEARCH HIGHLIGHTS

The Road to Affordable Green Hydrogen: Hydrogen Produced from Wind Power Can Be Cost-Competitive in China

Hydrogen produced from water using renewable energy could be key to a carbon-free future, but its production has long been thought too expensive for industrial-scale application.

Now, researchers from the Harvard China Project have found that using wind power to produce hydrogen could provide a cost-competitive alternative to coal-dominated hydrogen manufacturing systems in China.

The research was published recently in the journal *Renewable Energy*.

"This study provides evidence for both the sustainability and affordability of green hydrogen production," said Michael B. McElroy, the Gilbert Butler Professor of Environmental Studies, and senior author of the study. "Our findings could serve as a reference for the necessity for adjustments in the subsidies for renewable energy. Policymakers could lend support specifically for hydrogen investments to accelerate large-scale development and to lower the financial risks associated with renewable power investment."

To calculate the real costs of green hydrogen in China, the researchers developed an integrated power-hydrogen-emission framework and completed the analysis based on real-world data from China's Western Inner Mongolia region. The framework combined a high-resolution wind resource analysis with hourly simulation for the operation of power systems and hydrogen production. The research team studied the economic and technological feasibility of green hydrogen production taking into account actual power demand, assimilated wind speed data, power system operations and the different electrolysis methods used to extract hydrogen.

The researchers found that in a 50-gigawatt wind investment scenario, with a curtailment rate of 8.1%, all of the industrial demand for hydrogen in Western Inner Mongolia could be met by production from power generated from wind at a cost of 1.52 $/kg.

"Because of this research, we know that using wind power to produce hydrogen could provide a cost-competitive alternative to the region's current coal-dominated hydrogen manufacturing system, contributing at the same time to important reductions in wind curtailment and CO_2 emissions," said Lin Haiyang, a Visiting Fellow at the Harvard-China Project and first author of the study.

"The analytical methods and lessons developed here for China should be applicable to other countries, to Australia and Denmark for example, where green hydrogen is currently benefiting from strong public support," said McElroy.

Paper Cited: Haiyang Lin, Qiuwei Wu, Xinyu Chen, Xi Yang, Xinyang Guo, Jiajun Lv, Tianguang Lu, Shaojie Song, and Michael B. McElroy. 2021. "Economic and technological feasibility of using power-to-hydrogen technology under higher wind penetration in China." Renewable Energy, 173, 569-580.

Less Wind Due to Climate Change Won't Impact Wind Power Generation in India and China

Wind power is critical to reducing fossil fuel emissions and mitigating the impacts of global climate change but recently, scientists found that changes in climate may make wind a less reliable energy source. For example, one study found that a weakening land-sea temperature gradient due to rising temperatures is making historically windy regions, like Inner Mongolia in China, less windy.

But to what extent will wind power decline in the future? Answering this question is critical as more and more countries commit to decarbonization through renewable power.

Now, Harvard researchers have evaluated the potential change for on- and offshore wind power in China and India as a result of human-induced climate

change. They found that while wind power potential in both China and India will decrease in the future, the reduction is small - only about a 1% change in China and 2% in India.

The researchers found that regions with a decrease in potential are projected to have less diurnal and seasonal variabilities, which could actually allow for easier grid integration of wind power.

The research was published in *Environmental Research Letters*.

"Overall, there will still be enormous potential for wind power in China and India in the future and climate change should not present a major concern for its availability," said Peter Sherman, a graduate student in the Department of Earth and Planetary Sciences and first author of the paper.

The research team used high-resolution climate models under historical and future emissions scenarios to determine if and how regional climate changes could impact plans for wind power growth.

"Our research has important bearing on future electricity systems planning," said Michael McElroy, the Gilbert Butler Professor of Environmental Studies at the Harvard John A. Paulson School of Engineering and Applied Sciences and senior author of the paper. "While wind may go down a little, it's not enough to impact wind power integration and expansion, which must play a major role in carbon neutral aspirations."

Next, the researchers aim to extend this work to other regions, including Europe and the US, which recently faced multifaceted grid issues in Texas.

The team will also explore whether there are detectable changes to the solar power potential over these regions, which may be more sensitive to emissions changes as air quality can directly affect incoming solar radiation.

Paper Cited: Peter Sherman, Shaojie Song, Xinyu Chen, and Michael B. McElroy. 2021. "Projected changes in wind power potential over China and India in high resolution climate models." Environmental Research Letters, 16, 3.

Articles by Leah Burrows, Harvard John A. Paulson School of Engineering & Applied Sciences Communications.

Spring 2021: Virtual Events Recap

While the ongoing COVID-19 pandemic yielded a continued virtual event format, it also presented an opportunity for the Project to feature talks by collaborators direct from China.

The spring season was opened by **Yang Qing**, a Project alumna and professor in the School of Energy and Power Engineering, Huazhong University of Science and Technology. She drew a crowd of more than 100 attendees for a talk on the prospects for scalable production of biochar—a form of charcoal produced by pyrolysis of biomass in the absence of oxygen—as a negative-carbon option to help achieve China's decarbonization goals, while offering additional environmental benefits to both air quality and soil quality. Yang begun the research as a visiting scholar at the China Project, and published the study with other Project co-authors in *Nature Communications*.

Li Zheng, Executive Vice President of the Institute for Climate Change and Sustainable Development at Tsinghua University, gave the next talk. As an expert in energy systems analysis, performance modeling, and simulation and optimization of power plants, Li explored various decarbonization pathways for China's power sector. He provided an introduction to China's low-carbon strategy, and then discussed four separate decarbonization scenarios, increasing in ambition from achievement of China's existing 2030 targets from the Paris Agreement to one consistent with its 1.5°C warming target. He stressed among other factors the benefits of increased regional and transnational interconnection of power grids as the generation capacity shares of variable renewable power grows.

Teng Fei, Associate Professor and Deputy Director of the Institute of Energy, Environment, and Economy at Tsinghua University presented the final talk of the semester. Teng examined how phasing out of coal power plants in China relates to stranded assets, a term that means different things depending on a stakeholder's perspective. Teng unpacked the financial implications of a shift away from coal power to different actors.

Join the Harvard-China Project for future events by subscribing to our list serv or visiting our website, www.chinaproject.harvard.edu.

Harvard Names Vice Provost for Climate and Sustainability

James H. Stock, a Harvard professor and economist known for his expertise on energy and environmental policy, has been named the University's inaugural vice provost for climate and sustainability. Stock, who served on President Obama's Council of Economic Advisers, will work closely with faculty, students, staff, and academic leadership from across the University to guide and further develop Harvard's strategies for advancing climate research and its global impact. He will also support the achievement of the University's sustainability goals and will oversee ongoing collaborations, as well as new opportunities, among existing units at Harvard.

"I'm both excited, and humbled, to begin in my work," said Stock, who is the Harold Hitchings Burbank Professor of Political Economy, "because there is so much opportunity here, for us, together, to make a major impact on climate change.

"Harvard has a critical role to play in this effort. Our faculty and students are uniquely positioned to make key advances in the science of climate change, in its implications for human systems, and in how society can succeed in preventing the worst of those damages yet to come. It is also important to recognize and address the human side of the disruptions that will be caused by the transition to clean energy. All of this requires integrating different aspects of the problem: in the sciences, in green engineering and design, in health, in interactions with business, public policy, economics, and more."

Excerpted from the Harvard Gazette.
Image by Stephanie Mitchell.

UNDERGRADUATE RESEARCH

Summer Undergraduate Research Assistantships: Decarbonization in China and Asia

This summer, a select group of Harvard-China Project undergraduate researchers were hard at work, analyzing climate challenges through a variety of different lenses. From their hometowns across the globe, these seven students collaborated with HCP researchers on a variety of topics, including zero-carbon energy options for different contexts, sources of methane, and China's electricity reform. This fall, several of the summer participants are continuing as researchers, working with their advisors on papers for potential peer-reviewed publication. Below they share overviews of their summer work, made possible through generous funding from the Harvard Office of Career Services:

The Status of Global Shipping Emissions and Potential Decarbonization Strategies using Alternative Propulsion Methods

Jack Walker '24

Shipping is the dominant mode of transport for international trade. With this heavy reliance on container ships hauling immense amounts of cargo over vast ocean distances, combined with the shipping industry's dependance on fossil fuels, maritime emissions are becoming increasingly significant in the race to address anthropogenic climate change. My research documented the scale of current and projected carbon dioxide emissions—among other air pollutants—stemming from commercial shipping. Additionally, I looked into the regulatory efforts designed to address the immense air pollution stemming from maritime exhaust, on a international, regional, and country-specific basis.

The most rewarding aspect of my project was connecting with a incredibly enthusiastic mentor in Peter Sherman. He and the other HCP researchers took into account my research experiences and ROTC background, to design a unique project that was interesting to me and useful for HCP.

China's Electricity System Reform and Excess Coal Capacity

Lisa Wang '23

We tackled the problem of coal overcapacity in China, i.e., that many of the coal plants being built now are not going to be able to recoup their investment, and will be in an even more financially precarious position if the government limits emissions in a way consistent with the Paris Agreement. The first half of the summer was spent understanding why China continues to build coal plants despite this, understanding how the power market works, understanding the history of reforms, and understanding some of

the normative recommendations for the future. In the second half of the summer, I wrote a paper summarizing what I'd learned and also assisted Dr. Mun Ho on data entry. Learning about the major obstacles to renewable energy integration in the context of electricity system planning and lack of markets was very rewarding. The assistantship was very relevant to my future career aspirations, and it was interesting to learn about potential interactions between the emissions trading system and electricity system reform.

Analysis of Carbon Capture and Storage Technologies in the Cement Industry of China and the U.S.

Matthew Su '24

My research project explored the potential impact of implementing 4 different carbon capture and storage (CCS) technologies in the cement industry of China and the U.S. This was done via life cycle assessment, which measured the environmental impact of Portland cement production by modeling the various subprocesses that comprise the production system. My research identified amine-containing facilitated transport matrix technology as the CCS technology with the most potential impact on emissions, with a potential reduction of cement production emissions by nearly 60%.

I am planning to concentrate in chemistry at Harvard, and I think it would be cool to work in sustainable/clean energy technology in the future! This project helped me explore the potential and implementation of an interesting array of carbon capture technologies, and it opened my eyes to the usage of chemical principles in climate mitigation technology. The assistance of my mentor, Professor Xi Yang, in guiding my project was invaluable to its success. She was especially helpful in guiding my literature review process to focus specifically on the cement industry and life cycle assessment.

Preliminary Characterization of Methane Observations around Beijing

Candice Chen '22

I examined methane data from two stations, north and south of Beijing, to determine basic characteristics of observed methane, carbon dioxide, and carbon monoxide at these sites. I explored the diurnal, weekly, and annual variations of these species. During winter, there were enhanced CH_4:CO_2 ratios which could reflect more intense natural gas use and leakage during the winter.

I enjoyed how much flexibility I was given to search relevant literature and play with the data provided to me. This was the most independent I've been in doing research, and I got to learn more about evaluating results and deciding what next steps are most interesting.

This assistantship was a way for me to gain more experience with atmospheric science, a field I am considering doing more work in during graduate school. Regardless of the applicability of this project's topic on the projects I'll do in the future, I definitely benefitted from learning more about the research process. I hope to continue doing research for years to come, and this program played a role in continuing to affirm my enjoyment of the research process. My mentors, Shaojie Song and Bill Munger, were also so incredibly helpful throughout the process, both in recommending ways to look at the data and in describing the science to me.

Offshore Wind Opportunities in Southeast Asia

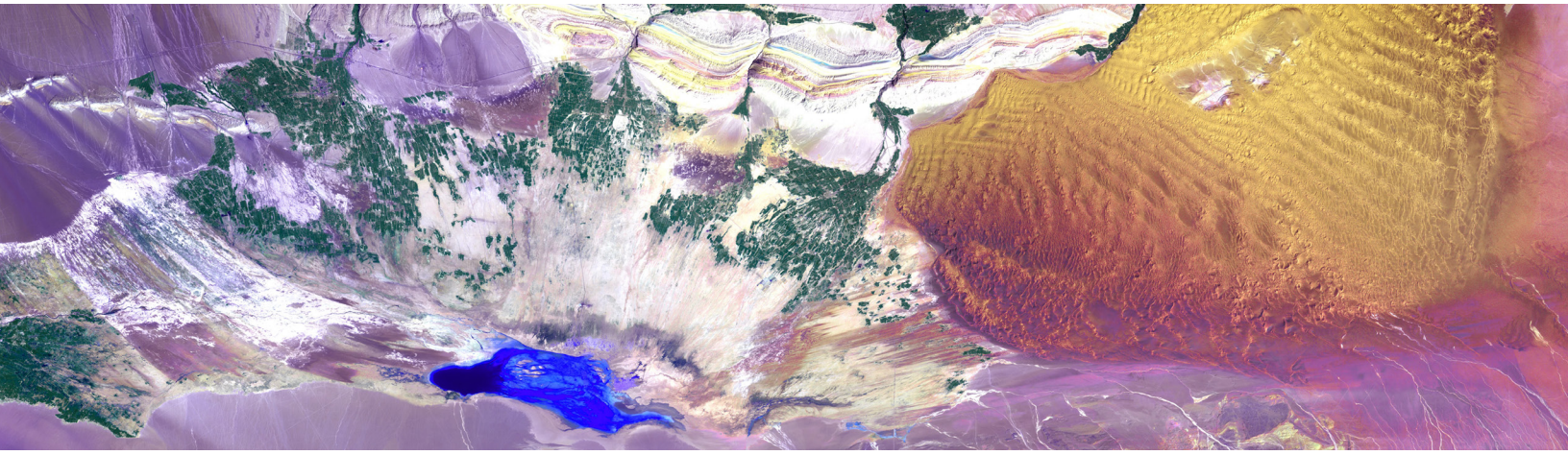
Estel Valeanu '23

In this project, I explored the offshore wind opportunities in Southeast Asia. My mentor, Peter Sherman, and I decided to do so because Southeast Asia is known for low water depth, which will allow installation of such turbines. We were interested specifically in Southeast Asia because of the fast population growth and the expected rapid growth in electricity demand. And in order to uphold the Paris agreement, Southeast Asia had to find non-polluting ways to generate electricity, and this could be a good one.

The most rewarding part of my research was determining that some places like south Vietnam, Cambodia, Myanmar and Indonesia (in areas near the Java Sea) can benefit from installing offshore wind turbines. This is due to high capacity factors and low LCOE (levelized cost of electricity).

I gained more experience with researching, writing code in MATLAB and writing a report that explains all the hard work that I did. Those skills are really important and I know that I will use them at Harvard and after college as well.

The Harvard-China Project routinely organizes summer opportunities for undergraduate research and short courses in China. In past years, students have undertaken summer-long research projects at Tsinghua University and the Chinese University of Hong Kong, advised by local faculty. The Project has also sent up to 30 students to the international summer school at Tsinghua's School of Environment, where they learned about and experienced China's environmental challenges first-hand, including on field trips and village field projects.



HCP RESEARCHERS IN THE NEWS

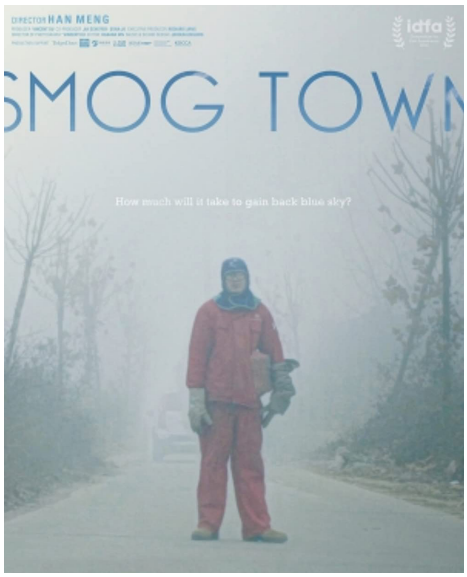
Climate 'Blue Paper' Commentary in *Carbon Brief*

China is a "sensitive" and "significantly affected" area of global climate change, according to the annual "blue paper" from the China Meteorological Administration (CMA), the government's lead institution on meteorological administration and research. The paper said that China's surface temperature had warmed at a rate of 0.26C per decade between 1951 and 2020, a rate higher than the global average of the same period, which measured 0.15C per decade. It added that China has experienced "rising" extreme weather events, such as heavy precipitation and high temperature. Various media outlets, from *Xinhua* and *Caixin* in China to *Carbon Brief* in the west, reported on the paper's release.

The blue paper showed clear evidence that human influence is causing changes in the climate system in China, according to Zhou Tianjun, a lead author of a chapter of the IPCC AR6. Zhou, of the Chinese Academy of Sciences, told *Carbon Brief*: "If we compare the key climate change indicators assessed in the 'blue paper' to that assessed in AR6 in a global perspective, we can see that climate change in China is a regional manifestation of global warming." **Michael B. McElroy**, Chair of the Harvard-China Project, told *Carbon Brief* that the blue paper provides an "important" account and context of the contemporary changes in China's climate system. McElroy noted that the paper highlighted the need for "immediate" investments in infrastructure that could at least partially mitigate future damage. "And it provides strong reasons for China to continue, if not expand, its current policies to reduce its emissions of climate-altering greenhouse gases, promoting similar objectives elsewhere in the world," he added.

DC Environmental Film Festival Screening & Discussion

The annual DC Environmental Film Festival, which ran a virtual format this year, screened Smogtown, a film from director Han Meng. The piece focuses on Langfang, about 40 kilometers from Beijing, and one of the cities suffering the worst air pollution in China. There is intense pressure from leadership in Beijing for the local environmental protection bureau to address the issue. This observational bureaucratic drama highlights a situation that parallels



the global environmental crisis: the urgency to tackle the problem is obvious, but how? And who will pick up the tab?

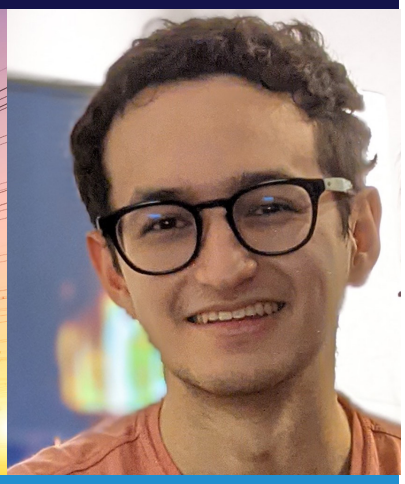
Following the film, a post-event discussion co-presented by the China Environment Forum of the Woodrow Wilson Center featured **Chris Nielsen**, Executive Director of the Harvard-China Project, Judith Shapiro of American University, and Jennifer Turner of the Wilson Center. Nielsen highlighted that much PM2.5 air pollution results from more complex and uncertain chemical and transport processes than non-specialists often realize, and sympathized with local officials overwhelmed by expectations to meet arbitrary reduction targets for a regional pollution problem that is substantially beyond their control.

China Global Television Network Coverage of Carbon Neutrality Seminar

In May, Beijing played host to an international carbon neutrality seminar to address China's efforts to address the climate crisis, drawing on expertise from a broad range of areas. With goals to reach peak carbon emissions by 2030 and carbon neutrality by 2060, China faces historic challenges. The experts largely agreed that the key to achieving the targets lie foremost in new forms of energy. **Michael B. McElroy**, chair of the Harvard-China Project, told the China Global Television Network that "The future of low carbon energy systems will depend on a continued expansion of the role of renewable energy."

RESEARCHER SPOTLIGHT

Peter Sherman
HCP Researcher and Ph.D Candidate



Watching a fast-paced NBA basketball game, most sports fans rarely pause to reflect on the analytics underpinning a team's game strategy. But the data *are* there.

"When a player is on the court, we can track where they are at any given time," says Peter Sherman, a Ph.D. candidate in Earth and Planetary Sciences, and researcher with the Harvard-China Project. "This is actually very similar to climate data as both highlight the importance of how things evolve spatially over time." Zeroing in on players' tracking metrics is akin to Peter's approach to scientific data, so contacting the Minnesota Timberwolves two years ago was only natural. The proposal, which the Timberwolves accepted, was simple—for Peter to remotely help gather and study game data to translate them into playmaking insights for NBA coaches and players.

Peter's interest in data extends far beyond the NBA, to matters of planetary importance. Here at Harvard, he is currently mentored by Michael B. McElroy, Gilbert Butler Professor of Environmental Science and Chair of the Harvard-China Project. Peter is working with McElroy on intersections between climate, renewable energy systems, and air quality, ranging from how shifting regional climate affects wind power potentials or pollution concentrations to how energy systems can best exploit renewable resources as they evolve. One of his recent publications shows how declining wind speeds in China and India—two focal areas of Peter's research, as key nations in global decarbonization—might even help their power systems accommodate larger shares of wind power, by reducing its temporal variability. Recently published in *Environmental Research Letters*, the study was the subject of a SEAS Communications profile (see page 4 for more information on this new research).

Despite the pandemic's limitations, Peter has found weekly Zoom meetings with other Harvard-China Project researchers not only enjoyable but helpful, fostering research collaborations such as an upcoming paper on electrolytic production of "green" hydrogen using offshore wind in China. "I did the offshore wind power calculations," says Peter. "And then Haiyang Lin, Visiting Fellow, and Shaojie Song, Research Associate, used that information to calculate how much hydrogen could be feasibly generated and cost-effectively supplied to domestic and international markets."

Collaborations with other researchers first led Peter towards a pursuit of climate change scholarship. In particular, he credits his previous mentor Erik van Sebille at Imperial College London's Grantham Institute for Climate Change with introducing him to scientific research. Peter originally intended to embark on a career in space physics while pursuing his joint Bachelor's/Master's degrees, but after an internship focused on how best to remove microplastics from the ocean, he shifted his focus. After that internship, the team published its results in Environmental Research Letters. The success of the paper highlighted how timely and impactful Peter's work could be. "It got quite a bit of press, so the fact that I could see the real-world impacts of this research pushed me in the direction of environmental science," says Peter.

After experiencing the value of mentorships, Peter is now giving back to emerging scientists. "I have been blessed with a lot of great mentors throughout my research career, and because of that I feel I also need to give back to younger students who should also have such opportunities." With support of the Harvard-China Project, he has been mentoring undergraduate Jonathan D'Souza (ESPP, class of 2023) as well as two high school students from Cambridge Rindge and Latin High School on a study of how India's climate may be affected by emissions changes as the world transitions out of the COVID-19 shutdown. All merited co-authorship of the resulting paper, now submitted and undergoing peer review. Post-Ph.D., Peter is also looking forward to expanding his research and mentorships through a career in academia. And, hopefully, participating in NBA games by continuing his data analysis on the side.

Written by Kellie Nault

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