



# CHINA PROJECT NEWSLETTER

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## CONNECT WITH US

The China Project has joined the following platforms:



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(Chinese website)





## China Project Research Highlights

### **Formation of Haze Pollution**

Chinese air pollution is less well understood than non-scientists realize. Working with collaborators in China, postdocs SONG Shaojie, GAO Meng and Prof. Mike McELROY have led a



comprehensive study to resolve large and puzzling differences in the acidity levels of haze fine particles in North China reported in the literature. Acid-

ity plays a critical role in the chemical mechanisms that drive the formation of secondary PM<sub>2.5</sub> and its resulting toxicity. Incorrect estimation of particle pH may have led to faulty conclusions in a number of prominent papers about the causes of Chinese haze.

Using field measurements of gases and particles to critically evaluate two thermodynamic models routinely employed to determine particle acidity, the team found errors in the models as well as problems in their application. A resulting conclusion that China's winter haze particles are generally within a moderately acidic range (pH 4 to 5), and not highly acidic (0) or neutral (7) as has been variously reported, may drive new insights into the fundamental chemistry causing severe haze episodes in China.

### **Economics and Policy**

Visiting scholar Prof. CAO Jing conducts studies in both dynamic

simulation of the Chinese national economy and applied microeconomics and policy. One study, with Ph.D. student ZHOU Yalin and Prof. Joe ALDY (Harvard Kennedy School), analyzes China's "Top 1000 Energy Consuming Enterprises Program", promoting energy conservation in China's largest firms. Previous studies found substantial energy saving from the program, comparing firms' performance to counterfactual energy behavior continued from a previous benchmark year. By instead employing a matching algorithm to select and compare similar firms subject and not subject to the policy, Cao and colleagues find surprisingly little policy effect on energy-saving behavior.

With Prof. Dale JORGENSON



(Department of Economics) and visiting scholar Mun S. HO, Cao also conducts key Project research on national carbon pricing policies. China recently announced a national carbon market, starting with the electricity sector in 2020. Cao and colleagues are using their general equilibrium model of China to examine effects of a variety of future policy options, including eventual extension of emission trading to more sectors, different permit allocations or revenue uses, and possible hybrid policies combining quantity-

and price-based (i.e., trading and tax) carbon pricing instruments.

### **Climate Impacts on Wind Power**

The carbon benefits and financial returns from Chinese wind power are sensitive to changing wind resources. Ph.D. student Peter SHERMAN, postdoc CHEN Xinyu, and Prof. Mike McELROY have used wind data derived from an assimilated meteorological database to estimate what wind



power in China would have been on an hourly basis from 1979 to 2015. The analysis indicates a steady decrease in generating potential over this period, with the

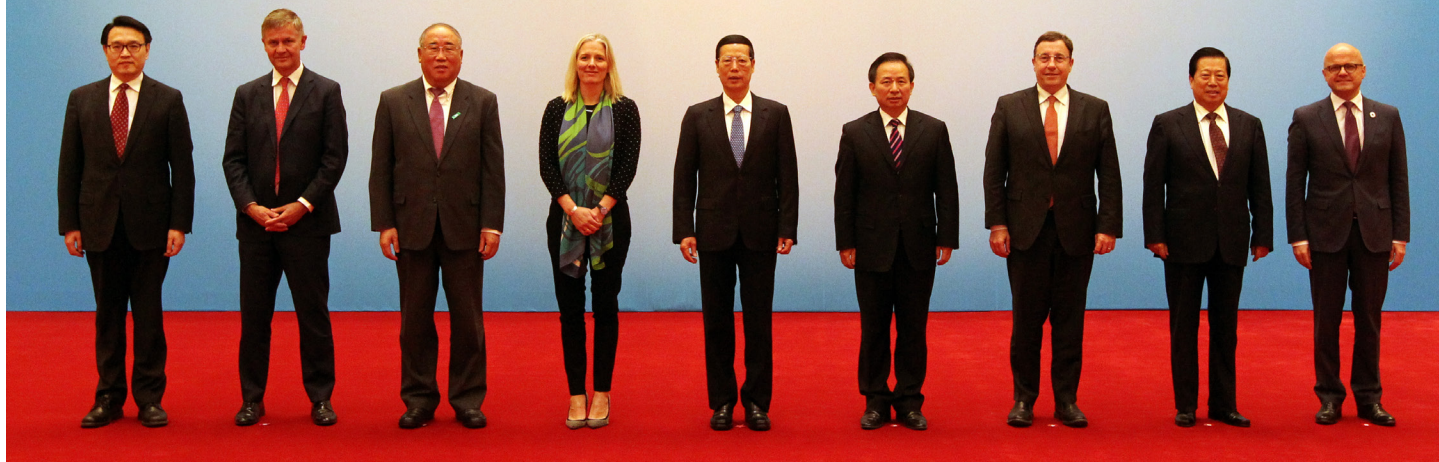
largest declines in two of the leading wind power regions China: western Inner Mongolia ( $-15\% \pm 7\%$ ) and northern Gansu ( $-17\% \pm 8\%$ ).

Taking account of natural climate oscillations, the wind decline is associated with long-term warming in Siberia and correlated with the observed increase in global average surface temperatures. China's ongoing massive investments in energy systems should take account of possible influences of climate change on future renewable resources. This research demonstrates the necessity and value of long-term forecasting of wind potentials.



# 中国环境与发展国际合作委员会2017年会

China Council for International Cooperation on Environment and Development Annual General Meeting



## Annual Meeting: China Council for International Cooperation on Environment and Development

Mr. LI Ganjie, China's Minister of Environment, named China Project Chair Prof. Mike McElroy to a 5-year term on the China Council for International Cooperation on Environment and Development (CCICED). The CCICED was founded in 1992 as a high-level international advisory body that assesses environment and development challenges and makes recommendations to top levels of the Chinese government. It is designed to share international environmental experience and knowledge and also to help the international community better understand China's environmental challenges. Formally chaired by Vice Premier ZHANG Gaoli, CCICED is actively led by two vice chairs, Ministers Li and Catherine McKenna (Minister of Environment and Climate Change of Canada) and several Chinese and international co-chairs including Minister XIE Zhenhua (China's Special Representative on Climate Change Affairs).

McElroy and China Project Executive Director Chris Nielsen attended the annual general meeting of the CCICED in early December, held at Diaoyutai State Guesthouse in Beijing. Participation provides the Project with an opportunity to introduce its research findings directly into discussions informing Chinese policy-making and to emphasize the role of independent research in understanding and addressing China's environmental risks. It also strengthens Project relationships with leading decision makers and thought leaders on environment and development from across China and around the world.



## Fall Semester Public Events & Seminars

The China Project welcomed film director WANG Jiuliang by live video link to a packed theater to screen and discuss his latest documentary, *Plastic China*, co-hosted by the Emergent Visions Film Series and Environment in Asia Event Series of the Fairbank Center and sponsored by the Harvard Global Institute. The film follows the daily lives of two families living in a typical plastic waste household-recycling workshop in China and explores not only how this work of recycling plastic waste with their bare hands takes a toll on their health, but examines as well their own dilemmas of poverty, pollution, and disease. Wang joined the event from Beijing for a Q&A moderated by Prof. ZHANG Ling of the Fairbank Center and

Boston College. The Q&A, driven by an animated and enthusiastic audience, touched on various socioeconomic and environmental themes of the documentary, as well as the filmmaking techniques involved.

The China Project also continued its China-focused interdisciplinary seminar series this past semester. Topics included the environmental and economic geography of small hydro-power plants; the value of health and the urban environment in Chengdu, preliminary findings from the China Project's time-series surveys; anthropogenic methane emissions; energy systems integration; and household consumption inequality in China and its implications for environmental policies.





## China Project hosts Reunion of Summer Undergraduate Program 2017 Alumni

In response to popular demand by a tight-knit cohort, the China Project held a small reunion in November for the Harvard students who participated in the “China’s Environmental Challenges” undergraduate summer program in Beijing this past summer.

More than twenty students attended the gathering, catching up with each other and with the program organizers and faculty. Given the success of the event, we plan to host a similar gathering in the coming semester.

*Photos: Students gather to reminisce (above); China Project Executive Director Chris Nielsen, left, looks at photo book with Abbott Lawrence Rotch Professor of Atmospheric and Environmental Science Steven Wofsy, who was a Tsinghua University guest lecturer during the program.*



## Adoption of Open Access Policy

The Harvard-China Project is pleased to announce that we have adopted an open-access policy, modeled after Harvard school-level policies, that grants the university a nonexclusive and worldwide right to make our research more accessible online. The China Project now has a dedicated collection in the Harvard open-access repository, DASH (Digital Access to Scholarship at Harvard). China Project affiliates also have the benefit of the Harvard open license,

allowing them to retain rights to their own works that they might not otherwise have retained, and to provide open access to their future scholarly articles without the need to negotiate with publishers. The open-access policy is consistent with the global nature of the China Project’s research mandate and a valuable tool in its integration of Harvard- and China-based scholarship to tackle more effectively the challenges of development and environmental protection in a changing climate.

## Recent Publications

Peter Sherman, Xinyu Chen, and Michael B. McElroy. 2017. “Wind-generated electricity in China: Decreasing potential, inter-annual variability, and association with climate change.” *Scientific Reports*, 7.

Haikun Wang, Yanxu Zhang, Xi Lu, Weimo Zhu, Chris P. Nielsen, Jun Bi, and Michael B. McElroy. 2017. “Trade-driven relocation of air pollution and health impacts in China.” *Nature Communications*, 8, 738.

Nan Zhong, Jing Cao, and Yuzhu Wang. 2017. “Traffic congestion, ambient air pollution and health: Evidence from driving restrictions in Beijing.” *Journal of the Association of Environmental and Resource Economists*, 4, 3: 821–856.

Archana Dayalu. 2017. “Exploring the wide net of human energy systems: From carbon dioxide emissions in China to hydraulic fracturing chemicals usage in the United States.” Ph.D. diss., Harvard University Department of Earth and Planetary Sciences.

Xinyu Chen, Michael B. McElroy, and Chongqing Kang. 2017. “Integrated energy systems for higher wind penetration in China: Formulation, implementation, and impacts.” *IEEE Transactions on Power Systems*.

Xi Lu and Michael B. McElroy. 2017. “Global potential for wind generated electricity.” In *Wind Energy Engineering: A Handbook for Onshore and Offshore Wind Turbines*, edited by Trevor M. Letcher. Amsterdam: Elsevier.

Changyi Liu, Yang Wang, and Rong Zhu. 2017. “Assessment of the economic potential of China’s onshore wind electricity.” *Resources, Conservation and Recycling*, 121:33–39.

Jing Cao, Mun Sing Ho, Yating Li, Richard G. Newell, and William A. Pizer. In press. “Chinese residential electricity consumption estimation and forecast using micro-data.” *Resource and Energy Economics*.

Michael B. McElroy, Xinyu Chen, and Yawen Deng. In press. “The missing money problem: incorporation of increased resources from wind in a representative US power market.” *Renewable Energy*.

Chenghe Guan. In press. “Urban form and digitalization of urban design.” *Urban Planning International*.

Shaojie Song, Meng Gao, Weiqi Xu, Jingyuan Shao, Guoliang Shi, Shuxiao Wang, Yuxuan Wang, Yele Sun, and Michael McElroy. 2018. “Fine particle pH for Beijing winter haze as inferred from different thermodynamic equilibrium models.” *Atmospheric Chemistry and Physics Discussions*.