Online Ethics Center
FOR ENGINEERING AND SCIENCE

PIRE: Developing Low-Carbon Cities in the US, China, and India Through Integration Across Engineering, Environmental Sciences, Social Sciences, and Public Health

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Description

A page describing the Partnership for International Research and Education funded by the National Science Foundation that brings together international researchers and students to conduct transformative research to contribute to the development of low-carbon, sustainable cities.

Body

Why it is unique or exemplary

This Partnership for International Research and Education (PIRE) award supports a five-year project that brings researchers and students from six U.S. institutions together with five partner institutions in India and three in China to conduct transformative research that will contribute to the development of low-carbon,

sustainable cities in the U.S., India, and China. There is a need for cities to have science-based tools to model present-day greenhouse gas (GHG) emissions associated with cities, and to project future GHG emissions reductions resulting from a combination of technology and policy strategies. This research effort is two-pronged, focusing on reducing greenhouse gas emissions in selected cities and also addressing broader sustainability goals such as economic development, water scarcity, environmental pollution, climate change, and public health.

PIRE research explores transformations needed in coupled technological, infrastructural, and social sub-systems that can help urban areas realize low-carbon, resource-efficient outcomes leading to sustainable cities. This project targets Asian cities in transition. These are small rapidly industrializing cities in Asia with populations less than 1M that are expected to dominate future urbanization. The investigators will compare their development trajectories with those of megacities having populations greater than 10M and smaller service-economy cities in the U.S., thus providing a road-map for sustainable development in different city types worldwide. The research team evaluated unique infrastructure interventions in smaller Asian cities --urban industrial symbiosis, early transportation planning incorporating bus rapid transit, and electric power sector planning under water-scarcity conditions-- that can achieve the multiple sustainability goals listed above. Social science research explored the extent to which local water-supply and public health concerns can motivate the adoption of low-carbon infrastructures, and researched the most effective political and institutional interventions that could facilitate their adoption in different city types. The interactions between infrastructures, social actors and sustainability outcomes are evaluated together using a novel inter-disciplinary Social-Ecological-Infrastructural Systems (SEIS) framework.

The intellectual merit of this project is that it integrates for the first time six diverse disciplines both in research and education using a science-based systems framework. Cross-disciplinary integration, urban-to-global linkages, integration of urban infrastructures with public health and governance, and international cross-city comparisons, taken together will advance the science of low-carbon cities.

Program description:

Participants (students, faculty, and others): This PIRE has directly involved close to 60 students and 20 faculty across three nations (U.S., India and China). Over 20 faculty from these three countries have been involved in the curriculum and research of this program.

We have conducted field research in Delhi, Agra, and Mumbai, which uncovered unequal distribution of infrastructure and pollution affecting low-income populations in these cities. The work in Delhi and Agra received wide public news coverage and policy engagement with local commissioners and mayors, who are grappling with issues of distributional ethics.

Original publication: http://pubs.acs.org/doi/full/10.1021/acs.est.5b03243

News coverage:

1. Times of India – Large-scale open burning of garbage damaging Taj: US study. http://timesofindia.indiatimes.com/india/Large-scale-open-burning-of-garbage-damaging-Taj-US-study/articleshow/49567408.cms
2. Wall Street Journal – How Trash Is Adding to Delhi's Air Pollution Problems. http://blogs.wsj.com/indiarealtime/2015/11/03/how-trash-is-adding-to-delhis-air-pollution-problems/
3. Times of India – Police lathicharge on colleagues' kin for protesting against burning of garbage. http://timesofindia.indiatimes.com/city/agra/Police-lathicharge-on-colleagues-kin-for-protesting-against-burning-of-garbage/articleshow/49620880.cms

Partnerships with the U.S. National Academy of Engineering Center for Engineering, Ethics & Society and the Chinese Academy of Sciences Institute for the Urban Environment enable the dissemination of research and education outputs, while work with NGOs such as ICLEI-Local Governments for Sustainability (South Asia), Urban Health Resource Centre (UHRC), and Resource Optimization Initiative (ROI) have helped help translate research into action in communities.

Through this work, collaborations have been formed with policymakers and practitioners from city and state governments.

Educational Goals: PIRE education has developed a first-of-its-kind International Summer School and MS Program on Sustainable Infrastructure-Sustainable Cities for graduate students in three nations drawn from six major disciplines: Engineering,

Environmental Sciences, Industrial Ecology, Urban Planning, Public Affairs and Public Health. Curriculum and fieldwork have nurtured multiple competencies addressing: inter-cultural learning, inter-disciplinary skills, sustainability knowledge, systems-integration, community-based practices, and awareness of ethics in global discussions of sustainability.

Methods or Content: We organize pre-trip training on intercultural sensitivity and discussed issues around being engaged in infrastructure-related policy work from an equity perspective.

Ethics modules were a part of parts of our educational curriculum in India in four ways:

1. Introduction Sen's Human Capability Approach with a discussion of the rights to basic needs for survival (e.g. Minimum amount of water, energy). We compared 3 ethical frames: the basic needs approach, utilitarian approach, and Sen's human capabilities approach.
2. Distribution of burdens and benefits: the distributional impact of health risks like air pollution.
3. Community-based policymaking: engaging with policymakers and communities (procedural ethics).
4. Doing new work on injustice (separate from inequality): discussions on injustice and inequality as we talk about infrastructure and risk.

Furthermore, ethics was included through actual research. Three publications illustrate this:

1. Chen Zhang, Xinyu Cao, Anu Ramaswami (2016). A Novel Analysis of Consumption-Based Carbon Footprints in China: Unpacking the Effects of Urban Settlement and Rural-to-Urban Migration. Global Environemntal Change. 39 285.
2. Nagpure, A.S., Ramaswami, A. Russell, A. (2015). Characterizing the Spatial and Temporal Patterns of Open-burning of Municipal Solid Waste (MSW) in Indian Cities. Environmental Science and Technology 49 (21), 12904-12912
3. Raj M Lal, Ajay S Nagpure, Lina Luo, Sachchida N Tripathi, Anu Ramaswami, Michael H Bergin and Armistead G Russell (2016). Municipal solid waste and dung cake burning: discoloring the Taj Mahal and human health impacts in Agra. Environmental Research Letters, 11 (10)

Assessment

We assessed the intercultural awareness of the U.S. students before and after the trip. Students were also asked to write reflections, blog posts, and travel journals reflecting on their experiences.

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Resource Type

Educational Activity Description

Topics

Climate Change
Collaboration
Controversies
Interdisciplinary Research
International Collaboration
Public and Community Engagement
Public Well-being
Sustainability

Discipline(s)

Engineering
Environmental Health
Life and Environmental Sciences
Public Health
Public Policy and Public Administration
Social and Behavioral Sciences
Urban Studies and Planning