Online Ethics Center
FOR ENGINEERING AND SCIENCE

Sustainable Cities and Interdisciplinary International Education

Description

The NAE's Center for Engineering Ethics and Society (CEES) has participated in an NSF Partnership in International Research and Education (PIRE) grant led by Anu Ramaswami (University of Minnesota) that focuses on "Developing Low-Carbon Cities in the USA, China & India through Inter-Disciplinary Integration Across Engineering, Environmental Sciences, Social Sciences & Public Health."

Abstract

The project page on the NAE CEES website is a collection of information about the NSF-funded Partnership in International Research and Education (PIRE) grant on "Developing Low-Carbon Cities in the USA, China & India through Interdisciplinary Integration across Engineering, Environmental Sciences, Social Sciences & Public Health."

Video: Expanding Urbanization, Education, and Human Futures - A video of the ethics session at the policy capstone workshop held at The National Academies in 2015, an article summarizing the project’s approach to interdisciplinary, international graduate education, and the article describing the framework that underlies that approach.

PIRE: Developing Low-Carbon Cities in the US, China, and India Through Integration Across Engineering, Environmental Sciences, Social Sciences, and Public Health - An educational description of the project including exemplary features, program description, and assessment.

Project Curriculum:

Ramaswami A., Russell A., Chertow, M., Hollander, R., et al. International, Interdisciplinary Education on Sustainable Infrastructure and Sustainable Cities: Key Concepts and Skills. ***The Bridge*****. 44: 3, Fall 2014**

> This paper describes an interdisciplinary education program offered to cohorts of graduate students from the United States, India, and China. Developed by an interdisciplinary team of university instructors from the three countries, the curriculum explores how the interaction of engineered infrastructures with social and natural systems shapes urban sustainability outcomes pertaining to resource management, environmental pollution, climate change, and public health. Five key concepts and skills
> https://www.nae.edu/Publications/Bridge/119585/119589.aspx

Project Framework:

Ramaswami, A., Weible, C., Main, D., Heikkila, T., et al. A Social-Ecological Infrastructural Systems (SEIS) Framework for Inter-Disciplinary Study of Sustainable City-Systems: An Integrative Curriculum Across Seven Major Disciplines. *J. Industrial Ecology*. Vol.16, Issue 6: 801-813, December 2012.

> Cities are embedded within larger-scale engineered infrastructures (e.g., electric power, water supply, and transportation networks) that convey natural resources over large distances for use by people living there. Their sustainability therefore depends upon complex, cross-scale interactions between the natural system, the transboundary engineered infrastructures, and the multiple social actors and institutions that govern these infrastructures. These elements are best studied in an integrated manner using a novel social-ecological-infrastructural systems (SEIS) framework. In the biophysical subsystem, the SEIS framework integrates urban metabolism with life cycle assessment to articulate transboundary infrastructure supply chain

water, energy, and greenhouse gas (GHG) emission footprints of cities. These footprints make visible multiple resources (water, energy, materials) used directly or indirectly (embodied) to support human activities in cities. They inform cross-scale and cross-infrastructure sector strategies for mitigating environmental pollution, public health risks and supply chain risks to cities. In the social subsystem, theories drawn from the social sciences explore interactions between individual resource users, infrastructure designers and operators, and policy actors—who interact with each other and with infrastructures to shape cities toward sustainability outcomes. Linking the two subsystems occurs by integrating concepts, theories, laws, and models across environmental sciences/climatology, infrastructure engineering, industrial ecology, architecture, urban planning, behavioral sciences, public health, and public affairs. Such integration identifies high-impact leverage points in the urban SEIS. An interdisciplinary SEIS-based curriculum on sustainable cities is described and evaluated for its efficacy in promoting systems thinking and interdisciplinary vocabulary development, both of which are measures of effective frameworks.
http://onlinelibrary.wiley.com/doi/10.1111/j.1530-9290.2012.00566.x/abstract

Ongoing Courses:

The ongoing University of Minnesota Twin Cities graduate program on Sustainable Infrastructure and Cities in the Center for Science, Technology, and Environmental Policy incorporates lessons from the PIRE project. Dr. Ramaswami leads seminars and independent study on sustainability systems research, including the following courses:

PA 8707 — Interdisciplinary Sustainability Systems Research Seminar

This seminar examines sustainability from the systems perspective. It explores what environmental sustainability, health, and well being mean for people and the planet; how these attributes are measured and prioritized by different stakeholders; and how different social-ecological and infrastructural systems transition toward improved health and sustainability outcomes.

PA 8991 — Independent Study

PA 5751 — Urban Infrastructure Systems for Sustainable and Healthy Cities

This interdisciplinary online course explores innovations both in physical infrastructure design and in the design of policies and institutions to advance the cause of sustainable, healthy cities. The course offers panel discussions from leading experts across 8 universities. Student projects take information from these panels and course readings, and map the pathways and potential barriers toward infrastructure transitions in a city, highlighting potential tradeoffs and co-benefits.

PA 5790 — Topics in Science, Technology, and Environmental Policy: Urban Food Systems and Policy

This course explores: A) the different policy objectives emerging in the narrative around urban agriculture and food systems, including social, environmental, and economic objectives; B) Emerging analysis tools to evaluate progress toward these objectives; and C) Pathways to achieve urban food system objectives from perspectives of urban farmers, farmers markets, food policy councils, etc.. The course includes guest lectures from faculty and practitioners alike, including mayors and food policy council members, and field visits to urban farms and food policy councils.

ExternalURL
http://www.nae.edu/Projects/CEES/57196/70831.aspx

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Resource Type

Educational Activity Description