

Equity, Energy and the Built Environment: Current Practices and Future Transitions

SUMA 5805 // Spring 2020 // Wednesdays, 6:10-8:00 PM // Carman Hall 111

Course Overview

Content

As the energy paradigm slowly shifts from fossil fuels to alternatives, issues of cost and equity on both supply and demand side become increasingly urgent. Populations impacted on both sides of energy production and consumption may share the benefits of empowerment, including potentials for greater energy independence; and the dangers of disempowerment, from the implications of fracking to the unjust distribution of systems cost. Within these considerations, the built environment is an important object of study. The built environment accounts for approximately 40% of energy consumption worldwide, including heating, cooling, lighting and electrical power; it affects all of humanity across cultural and political boundaries.

Buildings represent a middle ground between the enormity of infrastructure and the intimacy of human behavior. They are at the intersection of energy practices and social equity, where economic, health, environmental and cultural factors are most open to examination, with unexpected results. For example, recent studies in the US show an unexpected correlation between building insulation, usually of interest only to the landlord who pays for heat; and the likelihood of tenant disconnection notices for energy bills, usually associated only with consumer-billed electrical energy. Another example, derived from international sustainable development practice, has keyed ambient interior daytime temperature in homes and schools to productivity, education and other human development indicators.

This course is not only concerned with the benefits of adequate and equitable energy provision but also with the implications of transition to sustainable energy sources. Analysis of the relationship between energy and equity can expose otherwise unseen consequences of less environmentally impactful energy technologies, including natural gas as a bridge technology, or solar, wind and hydropower.

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The lecturers are available by email.
Students should expect an answer
within the next 24 hours.

Structure

The idea of “just transitions” will be explored in this context, drawing upon comparative policy approaches from different US state and international contexts. Concepts will be made tangible in case studies drawn from New York City, from your own experiences, from collaboration with a NY-based NGO and through a field trip. Leveraging the professors’ connections to primary research on building energy in New York City, a term project will look at two comparative residential sites, one culled from your own journaling and experiences. Interviews, technologies that track conditions in real time, energy bills and construction analysis will all be used to assess the current and potential future effects of the cost, source and availability of building energy on different households. Students will also complete two individual assignments –a field trip reflection that will include a modest research component and a self-analysis of thermal comfort in the form of a journal – in addition developing a team term research project that compares your own energy journaling to the experience of New Yorkers currently working with the not-for-profit Heat Seek.

This course will be structured using project-based learning opportunities to understand, through the lens of inclusion and equity, the intersection between technical building energy systems and the factors that influence how buildings are experienced. Specific to this course is its integrative scope, which will consider the financial, policy, physical and human factors that exist under current and prospective future energy systems. Students will gain technical knowledge and methodological skills to assess buildings and the systems that make them livable based on micro- and macro-level factors. These include but are not limited to: research into the legacy of housing, energy and equity in New York City; the operation and application of current building assessment instrumentation; spreadsheet-based energy assessment, including those used in engineering, architectural and operational contexts; interview-writing and completion; and visualization techniques.

Learning Objectives

By the end of this course, students will be able to:

- Define the temporal, spatial, demographic and socio-economic dimension of energy equity
- Identify systems interconnection of architecture, policy, technology and human factors in assessing energy equity
- Identify both physical and intangible aspects affecting energy equity, especially at the building scale
- Define governance strategies and pitfalls to address energy equity
- Propose specific frameworks that characterize energy equity risks, the actors involved and pathways towards sustainability
- Apply basic protocols of building energy assessment using equipment loaned by the course
- Synthesize and present complex systems to explore threats to equity during sustainable energy transitions
- Engage stakeholders and consider their perspectives when solving problems

Readings and Websites

All reading material, composed of peer-reviewed articles, news articles and technical reports will be made available through coursework and will be discussed during lessons. No specific coursebooks are mandatory, although recommended books/websites for the class are listed below. The students are encouraged to post any relevant documentation of any kind on the class' discussion page to illustrate the many facets of water security.

- Alisdair McGregor, Cole Roberts and Fiona Cousins, *Two Degrees. The Built Environment and Our Changing Climate* (Routledge, 2013)
- James Marston Fitch, *American Building: The Environmental Forces that Shape It* (Various editions) <https://www.sbse.org/> See this webpage for overview lectures and technical approaches to building energy and sustainability
- <https://www.ibp.fraunhofer.de/en/expertise/energy-efficiency-and-indoor-climate.html> See this webpage for state-of-the-art research and tracking of energy efficiency and thermal comfort and health
- <https://www.homeinnovation.com/> Organization focused on market research and uptake of energy efficiency and new energy options for residential construction

Resources

Writing Center

The Writing Center provides writing support to undergraduate and graduate students. In one-on-one consultations and workshops, consultants offer feedback and strategies to help you improve at every stage of your writing, from brainstorming to final drafts.

<https://www.college.columbia.edu/core/uwp/writing-center>

Columbia University Library

Books are underused and underrated, but you have access to Columbia's extensive library system. Check out the online catalogue. Avery is the world's largest architectural library, visit it before you graduate. <https://clio.columbia.edu/>

SPS Academic Resources

The Office of Student Affairs provides students with academic counseling and support services such as online tutoring and career coaching.

<http://sps.columbia.edu/student-life-and-alumni-relations/academic-resources>.

Columbia University Information Technology (CUIT) Computer Use Policy

Columbia University requires that all individuals accessing University electronic information resources to abide by the standards of acceptable usage indicated within this policy. The University is not responsible for information or materials residing on non-University systems or available over publicly accessible networks even if accessed via the University's network. Such materials do not necessarily reflect the attitudes, opinions, or values of the University, its trustees, faculty, staff, or students. Columbia University's network and computing technology provides information, data, and communication services. Responsible use of electronic information resources is necessary to create and maintain an open community of responsible users based on mutual respect and

cooperation, commitment to the integrity of resources and data, and compliance with all University policies and federal, state, and local statutes.

Course Requirements and Assignments

There are three individual assignments and one multipart collaborative research-based project required of this course. Submission requirements and due dates are also listed below. All submissions must be uploaded to courseworks before the start of class on the day due.

The three individual assignments will challenge students to reflect upon the history of energy equity in the built environment through readings; to consider the history of the built environments energy systems from a social perspective based upon a field trip; and to document their own experience of thermal comfort, physiologically and spatially, and its effect on their daily lives. These are all individual assignments. The three individual assignments are:

1. Weekly readings and responses to readings on course topics (an average of 35-50 pages of readings for each class with web posts on courseworks due at 2:00 PM before class)
2. A field trip to The Lower East Side Tenement Museum (1500 word response due Week 4)
3. Entries in a daily journal, maintained over the course of the semester, of personal thermal comfort in the built environment including use of energy assessment equipment (daily notes on weather, interior climate, productivity, mood and health; journal due in last week of class)

The long-form assignment has two parts, one observational and field work-based, another based on information provided by the not-for-profit Heat Seek. Students will collaborate in teams of 4-5, each of which will complete a comparative building energy analysis of their own thermal comfort journaling and information provided by Heat Seek on the people for whom they advocate. To assist students, progressive assignments will be due through out the semester (see separate assignment sheet). The team members will be assigned by the professors and, if needed, regrouped to ensure equitable distribution of student effort and learning:

1. Create a replicable method to extract the findings from your journal to serve as a comparative basis for the information that will be provided by Heatseek case studies;
2. Analyze and evaluate the information on participants' energy concerns in the Heatseek case studies;
3. Compile documentation including drawings, historical information, energy bills, policy documents and building measurements of the buildings at stake;
4. Develop a hypothesis that includes both diagnosis of current building energy conditions and proposals for changes to conditions by which energy is deployed, sourced and/or billed;
5. Complete adequate research to support your hypothesis;
6. Develop and refine visualization strategies for representing your findings;

7. Present research findings to the rest of the class and invited stakeholders, including proposed household-scaled strategies for just energy transition in the New York City. A revised final slide deck including bibliography and back-up documentation will be due on the first day of exam week, May 5th.

Evaluation and Grading

The final grade will be calculated as described below, based upon a standard A-F scale:

Assignment	% of Grade
In class participation, attendance and web posts prior to class on readings	15
Essay, NYC Tenement Museum (1500 word paper)	15
Thermal comfort journal for duration of course	25
Comparative thermal comfort group project (process)	20
Comparative thermal comfort project presentation (product)	20

Course Policies

Participation and Attendance

We expect you to come to class on time and thoroughly prepared. We will keep track of attendance and look forward to an interesting, lively and confidential discussion. If you need to miss a class for any reason, you must notify us and/or the TA the absence with us in advance. Absence not communicated at least 24 hours before class will constitute an unexcused absence except in the case of documented personal or health emergencies. Unexcused absences will result in the forfeiture of credit in the class participation portion of the grade. Multiply unexcused absences can result in a failing grade.

Late Work

There will be no credit granted to any written assignment that is not submitted on the due date noted in the course syllabus. In the case of documented personal or medical emergency, contact the professors as quickly as possible.

Citation and Submission

All written assignments must follow one of the recommended citation format ([see this link](#)), cite sources, and be submitted to the course website or as specified. Your written journals will be returned to you after grading.

School Policies

Copyright Policies

Please note—Due to copyright restrictions, online access to this material is limited to instructors and students currently registered for this course. Please be advised that by clicking the link to the electronic materials in this course, you have read and accept the following:

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials. Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specified conditions is that the photocopy or reproduction is not to be “used for any purpose other than private study, scholarship, or research.” If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of “fair use,” that user may be liable for copyright infringement.

Academic Integrity

Columbia University expects its students to act with honesty and propriety at all times and to respect the rights of others. It is fundamental University policy that academic dishonesty in any guise or personal conduct of any sort that disrupts the life of the University or denigrates or endangers members of the University community is unacceptable and will be dealt with severely. It is essential to the academic integrity and vitality of this community that individuals do their own work and properly acknowledge the circumstances, ideas, sources, and assistance upon which that work is based. Academic honesty in class assignments and exams is expected of all students at all times. SPS holds each member of its community responsible for understanding and abiding by the SPS Academic Integrity and Community Standards posted at <http://sps.columbia.edu/student-life-and-alumni-relations/academic-integrity-and-community-standards>. You are required to read these standards within the first few days of class. Ignorance of the School’s policy concerning academic dishonesty shall not be a defense in any disciplinary proceedings.

Plagiarism will be recognized and will result in forfeiture of all credit for the written assignment in which plagiarized text has been used.

Accessibility

Columbia is committed to providing equal access to qualified students with documented disabilities. A student’s disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University’s Health Services website: <http://health.columbia.edu/services/ods/support>.

Course Schedule and Calendar

Part I: Energy, Empathy and Equity

Week 1 Jan 22: Introduction to Concepts and Course Content

- **Lecture (DH/LW):** Energy forms and their Cultural Context – Energy Burden, Energy Parity, Energy Insecurity, Thermal and Electrical Energy, Thermal Comfort, Urban Microclimates
- **Reading:**
 - Sandra Lenzholzer, *Weather in the City: How Design Shapes the Urban Climate* (naioio publishers: Rotterdam, 2015) Chapter 1 and 2, pp. 18-51 (33 pp.);
 - Peter Silver et al, *Introduction to Architectural Technology* p. 72-75 (3 pp);
 - Horta, A., Wilhite, H., Schmidt, L., & Bartiaux, F. (2014). Socio-technical and cultural approaches to energy consumption: An introduction. *Nature and Culture*, 9(2), 115-121. (6 pp)
 - Hernández, D. (2015). Sacrifice along the energy continuum: a call for energy justice. *Environmental Justice*, 8(4), 151-156.
- **Assignment:** Scheduling of visit to Lower East Side Tenement Museum

Week 2 Jan 29: Historic Building Types and their Energy/Wellbeing Scenarios

- **Lecture (LW):** Residential Design and Building in New York City/Responses
- **Reading:**
 - Richard Plunz, *A History of Housing in New York City*, Preface (10 pages) also [see this link](#) to review floor plans from the 1890s onwards;
 - Michael Osman, *Modernism's Visible Hand* (Chapter 1 excerpt, 31-44) (13 pp);
 - Daniel Barber, 'Climate Sensitive Architecture as a Blueprint' *RCC Perspectives*, No. 2, *Energizing the Spaces of Everyday Life: Learning from the Past for a Sustainable Future* (2019), pp. 77-86 (9 pp)
- **Assignment:** Thermal comfort/energy drawdown journal; Essay questions for Tenement Museum visit response

Fieldtrip: Lower East Side Tenement Museum

Week 3 Feb 5: Powerless: The Human Side of Household Energy

- **Lecture (DH):** Introduction to key concepts and framing of energy insecurity and energy justice
- **Readings:**
 - Jessel, S. G., & Hernández, D. (2019). Energy, Poverty, and Health in a Changing Climate: A Conceptual Review of an Emerging Literature. *Frontiers in Public Health*, 7, 357;
 - Hernández, D. (2016). Understanding 'energy insecurity' and why it matters to health. *Social Science & Medicine*, 167, 1-10 (10 pp);
 - Hernández, D., & Siegel, E. (2019). Energy insecurity and its ill health effects: A community perspective on the energy-health nexus in New York City. *Energy Research & Social Science*, 47, 78-83.
- **Assignment:** Submit first journal entries (scan/submit on courseworks) for feedback and correction

Part II: Thermal Energy

Week 4 Feb 12: Guest Lecture Heat Seek

- **Lecture:** Noelle Francois, Executive Director and Anthony Damelio, Director of Programs
- **Readings:**
 - <https://heatseek.org/>
 - <https://www.nydailynews.com/news/politics/pols-temperature-sensors-nyc-homes-heat-violations-article-1.4001887>
 - <http://www.cuny.tv/show/independentsources/PR2006514>
 - <https://www.wsj.com/articles/new-tech-helps-tenants-make-their-case-in-court-1481590049>
- **Assignment:** Launch collaborative research project and configure groups; ongoing journaling
- **Due:** Analytical Essay on the Lower East Side Tenement Museum

Week 5 Feb 19: Methods of energy analysis – thermal, plug loads

- **Lecture (LW):** Instruments for monitoring, interview methods, tracking urban microclimates, user interfaces
- **Readings:**
 - Kohta Ueno, 'How to Look at a House Like a Building Scientist (Part 2: Heat), December 4, 2019. Building Science Corporation website <https://www.buildingscience.com/documents/published-articles/pa-1902-how-look-house-building-scientist-part-2-heat>;
 - Sandra Lenzholzer, Weather in the City: How Design Shapes the Urban Climate (naioio publishers: Rotterdam, 2015) Chapters 5 and 6 (32 pages);
 - Julia Day and William O'Brien, 'Oh Behave! Survey Stories and Lessons Learned from Building Occupants in High Performance Buildings', in: 'Energy Research & Social Science' v. 31, September 2017, 11-20 (9 pages)
- **Assignment:** Ongoing work on collaborative research project; ongoing journaling; initiate instrumentation and begin quantitative assessment of energy in your daily life
- **Due:** Prepare questions on Heatseek information as needed for submission as group

Week 6 Feb 26: Appliances and household equipment in cultural context

- **Lecture (LW/DH):** Cultural history of appliance, appliances as markers of energy empowerment/inequity, gaming to increase energy literacy
- **Reading:**
 - Sigfried Giedion, Mechanization Takes Command, pp. 612-27 (15 pages);
 - Kammerer, D. (2009). The effects of customer benefit and regulation on environmental product innovation: Empirical evidence from appliance manufacturers in Germany. Ecological Economics, 68(8-9), 2285-2295. (10 pages; you may skip the explanation of the research modeling);
 - Austin Troy, The Very Hungry City Chapter 1 pp.13-31 (18 pages)
- **Assignment:** Ongoing collaborative research project; ongoing journaling
- **Due:** Instrumentation results, individual Energy Drawdown Journal

Part III: Lighting

Week 7 March 4: Lighting, Daylighting and Sustainable Architecture

- **Lecture (LW):** Lighting Design – principles, metrics and effects
- **Readings:**
 - Marilyne Andersen, ‘Unweaving the Human Response in Daylight Design’ (Building and Environment 91 (2015)) (13 pp);
 - Alison Kwok and Walter Grondzik, The Green Studio Handbook Chapter 4 Lighting pp. 79-125 (46 pp).
- **Assignment:** Begin comparative analysis of Heat Seeker case studies and journaling
- **Due:** Extracted information from individual Journal for group comparative work

Week 8 March 11: Lighting, Perception and Human health

- **Lecture (DH/ guest lecturer Micaela Martinez):** Lighting sources and transitions, circadian rhythms and health benefits of daylighting
- **Readings:**
 - Reames, T. G., Reiner, M. A., & Stacey, M. B. (2018). An incandescent truth: Disparities in energy-efficient lighting availability and prices in an urban US county. Applied energy, 218, 95-103 (12 pp);
 - Dominoni, D. M., & Nelson, R. J. (2018). Artificial light at night as an environmental pollutant: An integrative approach across taxa, biological functions, and scientific disciplines. Journal of Experimental Zoology. Part A, Ecological and integrative physiology, 329(8-9), 387;
 - James, P., Bertrand, K. A., Hart, J. E., Schernhammer, E. S., Tamimi, R. M., & Laden, F. (2017). Outdoor light at night and breast cancer incidence in the Nurses’ Health Study II. Environmental Health Perspectives, 125(8), 087010.
- **Assignment:** Ongoing work on journaling and comparative term project

March 16-22 Spring Break

Week 9 March 25: Student Progress Report

- **Due:** In-class presentation of initial analysis and interview results from student working groups on thermal and energy journaling compared to information provided via Heat Seek

Week 10 April 1: Energy Policies to Address Equity

- **Lecture (DH):** Policy Innovations on Energy in New York City and Beyond
- **Readings:**
 - Jenkins, K., McCauley, D., Heffron, R., Stephan, H., & Rehner, R. (2016). Energy justice: a conceptual review. Energy Research & Social Science, 11, 174-182. (12 pp);
 - Bouzarovski, S., & Simcock, N. (2017). Spatializing energy justice. Energy Policy, 107, 640-648. (8 pp);
 - Reames, T. G. (2016). Targeting energy justice: Exploring spatial, racial/ethnic and socioeconomic disparities in urban residential heating energy efficiency. Energy Policy, 97, 549-558. (11 pp);

- Lewis, J., Hernández, D., & Geronimus, A. T. (2019). Energy efficiency as energy justice: addressing racial inequities through investments in people and places. *Energy Efficiency*, 1-14 (14 pp)
- **Additional Readings:**
 - Carrión, D., Lee, W., & Hernández, D. (2018). Residual Inequity: Assessing the Unintended Consequences of New York City's Clean Heat Transition. *International journal of environmental research and public health*, 15(1), 117. (10 pages);
 - Bird, S., & Hernandez, D. (2012). Policy options for the split incentive: Increasing energy efficiency for low-income renters. *Energy Policy*, 48, 506-514. (8 pages)
- **Due:** Draft Storyboard/powerpoint for final presentation

Week 11 April 8: Just Transition and Resilience

- **Lecture (DH, guest lecturer Liv Yoon)**
- **Readings:**
 - Hernández, D., Chang, D., Hutchinson, C., Hill, E., Almonte, A., Burns, R., ... & Evans, D. (2018). Public housing on the periphery: vulnerable residents and depleted resilience reserves post-Hurricane Sandy. *Journal of urban health*, 95(5), 703-715. (12 pp);
 - Harrahill, K., & Douglas, O. (2019). Framework development for 'just transition' in coal producing jurisdictions. *Energy Policy* 134. doi.org/10.1016/j.enpol.2019.110990;
 - Healy, N., & Barry, J. (2017). Politicizing energy justice and energy system transitions: Fossil fuel divestment and a "just transition." *Energy Policy* 108. doi.org/10.1016/j.enpol.2017.06.014
- **Assignment:** Workshop on term project

Week 12 April 15: Heat and the City

- **Guest Lecture:** Sonal Jessel WE ACT for Environmental Justice- <https://www.weact.org/campaigns/heat-health-equity/>
- **Readings:**
 - Klinenberg, E. (1999). Denaturalizing disaster: A social autopsy of the 1995 Chicago heat wave. *Theory and society*, 28(2), 239-295.
 - <https://www.nytimes.com/2019/05/24/health/climate-change-elderly.html>
 - <https://www.wnyc.org/story/life-new-york-public-housing-no-air-conditioning/>
 - <https://www.npr.org/2019/09/03/754044732/as-rising-heat-bakes-u-s-cities-the-po-or-often-feel-it-most>
- **Assignment:** Workshop on term project

Week 13 April 22: Guest Lecture

- **Lecture: Prof. Forrest Meggers**, Princeton University School of Architecture and Andlinger Center for Energy and the Environment
- **Readings:** TBD
- **Assignment:** Workshop on term project

Week 14 April 29: Student Presentations

Due May 5th: Final individual journals and final slidedecks for grading

Biographies of Guest Lecturers

Sonja Jessel

As one of WE ACT's Policy and Advocacy Coordinators, Sonal works to advance the organization's policy agenda at the local, state, regional, and national level, and leads the Northern Manhattan Climate Action (NMCA) Plan. Prior to joining WE ACT, she conducted research in energy insecurity, housing, and public health at Columbia University, and coordinated clinical trials at Weill Cornell Medicine. With roots in California and Connecticut, Sonal has an MPH in Population and Family Health with a concentration in Climate and Health from Columbia University's Mailman School of Public Health, and a BA in Organismal Biology from Pitzer College, in California. Her interest is focused on the intersection of environmental and social justice, health, and policy.

Micaela Martinez

Dr. Martinez is an infectious disease ecologist. Her primary focus is understanding the drivers that shape seasonality in infectious disease systems, with particular interest in the impact of biological rhythms (i.e., circadian and circannual rhythms) on disease. Her current projects aim to inform vaccination policy by revealing how demographic, physiological, and environmental factors intersect in epidemic-prone disease systems, including poliomyelitis, measles, and chickenpox. Dr. Martinez also conducts research on maternal immunity in infants and is building a statistical inference pipeline for studying vaccine modes of action. She utilizes cutting-edge statistical inference techniques and mathematical models to couple disease incidence data with clinical data to gain insight into the transmission dynamics of disease.

Forrest Meggers

In 2013 Dr. Forrest Meggers came to Princeton jointly appointed in the School of Architecture and the new Andlinger Center for Energy and Environment. He founded and directs CHAOS (Cooling and Heating for Architecturally Optimized Systems) Lab where he and his research team investigate alternative thermal paradigms to engage architecture and maximize performance. He has been awarded funding at Princeton for several "Campus as a Lab" projects and for several technology innovations. He has grants from NSF, DOE, and ARM, and he collaborates with industry. He has several patents and founded the spinoff Hearth Labs to develop his SMART sensor technology to improve thermostats. He was previously in Singapore as Assistant Professor in the Dept. of Architecture at the National University of Singapore where he had traveled initially as a senior researcher and research module coordinator in the Singapore-ETH Centre's Future Cities Laboratory. He has degrees from Mechanical Engineering (BSE), Environmental Engineering (MS), and Architecture (Dr Sc.). His fields of knowledge include building systems design and integration; sustainable systems; renewable energy; radiant systems, desiccants, exergy analysis; geothermal; seasonal energy storage; building materials; thermodynamics and heat transfer; and heat pumps.

He received his PhD in the Dept. of Architecture at the ETH Zurich. Originally a native of Iowa, Forrest worked on many sustainability projects at the University of Iowa, and worked with Jim Hansen, renowned climatologist at Columbia University and director of NASA GISS, as a Researcher on US Building Stock CO2 emissions. Through all his international and research experiences he always prides himself as an Iowan and a bicycle mechanic.

Liv Yoon

Liv Yoon is a Postdoctoral Research Scholar at the Earth Institute, working at the Columbia Mailman School of Public Health with Dr. Diana Hernandez for the next two years. She obtained her PhD at The University of British Columbia in Vancouver, Canada where she studied intersections of environmental politics, communication, and social inequality surrounding an Olympic-related development project. She has a background in Socio-cultural Kinesiology, with a focus on social determinants of health and multiple intersecting axes of social inequality surrounding individual and collective bodies more broadly. For her postdoc, Liv plans to explore the socio-political dimensions and lived experiences of 'Just Transition' – communities shifting away from fossil fuel and/or coal-based economies. Using a participatory documentary process, she hopes to produce a documentary with community members to make these successful cases of communities in transition more visible, and mobilize knowledge gained from them. In addition, she will work on collaborative projects with Dr. Hernandez, including but not limited to, initiatives of the Community Engagement Core (CEC) in the Center for Environmental Health in Northern Manhattan.