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Energy, Equity, Housing and Health (E2H2) Program

Impact Report

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COLUMBIA | MAILMAN SCHOOL OF PUBLIC HEALTH
ENERGY, EQUITY, HOUSING AND HEALTH (E2H2) PROGRAM

OVERVIEW

The Energy Equity, Housing & Health (E2H2) program is a nationally recognized research and policy academic enterprise addressing energy insecurity as a foundational driver of health inequities, housing instability, and climate vulnerability. Under the visionary leadership of **Dr. Diana Hernández**, E2H2 generates rigorous, actionable evidence; translate research into policy and regulatory solutions; and partner with communities, governments, and practitioners to advance equitable access to affordable, reliable, and safe energy. Our work has been supported by major public and philanthropic funders and has informed local, state, national, and international decision-making across public health, energy regulation, housing policy, and climate adaptation.

Dr. Hernández started E2H2 as a Working Group in 2013; it advanced to a school-wide program at Mailman in 2023. In this time, we have trained hundreds of students at all levels from high school seniors, undergraduates and those in master's program to doctoral candidates and postdoctoral trainees that are now professors around the world! Our work has been instrumental in shaping the burgeoning field of energy equity in the US, offering clarity on the links between housing, health equity and climate and is foundational to the study of energy insecurity.

Since launching the program, E2H2 has conducted various studies related to energy equity, housing, community well-being and climate challenges with a local focus in NYC as well as global cities. We have disseminated our work to reach wide audiences by publishing a first of its kind book, *Powerless*, dozens of peer-reviewed articles, policy and field reports, a short documentary and a dedicated social media platform. We have emphasized policy translation by focusing on the structural determinants of energy insecurity that require systems change. More recently, our approach has included building networks and making resources publicly available to build capacity that advances research and action in our core areas of interest.

This impact report provides more information about our recent accomplishments and areas of focus and will be updated periodically to reflect our latest work and impact.

Learn more about E2H2: E2h2@hernandez.com

Meet our Team: https://e2h2hernandez.com/team/

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🔷 RESEARCH HIGHLIGHTS AND ESSENTIAL READINGS

Funded, Peer-Reviewed, Policy-Relevant Research

E2H2 research has been recently supported by the *National Institutes of Health*, *National Science Foundation*, and the *Alfred P. Sloan*, *Robert Wood Johnson* and *Freedom Together Foundations*. Our research has been published in leading journals including *Health Affairs*, *The Lancet Public Health*, *American Journal of Public Health*, and *Energy Policy*, strengthening the evidence base for supporting healthy housing and treating household energy as a public health necessity.

Essential Readings:

- *Powerless: the People's Struggle for Energy* (Russell Sage Foundation, 2025)
- *Understanding Energy Insecurity and why it matters to health* (Social Science & Medicine, 2016)
- *Energy, poverty, and health in climate change: a comprehensive review of an emerging literature* (Frontiers in public health, 2019)
- *Housing at the intersection of health and climate change* (The Lancet Public Health, 2025)
- *Housing as a determinant of health equity: A conceptual model* (Social Science & Medicine, 2019)

View full E2H2 publications list → https://e2h2hernandez.com/publications/

🔷 RECENT ACCOMPLISHMENTS & AREAS OF FOCUS SINCE 2023

Establishing Methods and Evidence on Energy Insecurity in the US

Our research demonstrates how energy insecurity and service disruptions shape health outcomes, particularly for historically marginalized communities. Collectively, this body of work advances new indicators, field-based methods, and empirical evidence to support policy-relevant interventions in urban energy systems, while centering lived experience and community voice.

> ***Research Highlight***
> Approximately one in ten households in the U.S. are energy insecure while four in ten are at risk. These statistics alone do not convey the acute pain of utility shutoffs, or the relentless toll of chronic energy hardships marked by difficult choices and harsh living conditions. Drawing on survey data and interviews with one hundred energy-insecure individuals and families, Hernández and Laird detail the experience of energy insecurity in the U.S. in a first-of-its-kind book. *Powerless* is being studied widely in and outside of academia for new insights and inspiration to take the necessary action to understand and stamp out this hidden hardship.

- *Powerless: the People's Struggle for Energy* (Russell Sage Foundation, 2025)
- *Surviving a shut-off: US households at greatest risk of utility disconnections and how they cope* (American Behavioral Scientist, 2022)
- *Race, Rates, and Energy Insecurity: exploring racial disparities in electricity costs and consumption in U.S. utility service areas* (Scientific Reports, 2025)
- *Racial and Ethnic Disparities in the Relationship Between Homeownership, Income, and Energy Insecurity* (Housing Policy Debate, 2025)
- *Understanding energy insecurity in the Field: A Toolkit for Community Members, Researchers and Local Practitioners* (American Public Health Association, 2025)

Energy Insecurity and Other Inequities in New York City and State

In a project supported by the Alfred P. Sloan Foundation to examine energy in security in NYC done in partnership with the NYC Department of Health and Mental Hygiene, we have documented associations between energy insecurity and respiratory, mental health, cardiovascular outcomes and unequal exposure to utility service interruptions across the city. To better understand the issues, we interviewed New Yorkers on the street and in their homes and shared their perspectives on our social media platform, @hotandcold_NYC and in a short documentary screened at APHA's annual conference in 2025. We also published two policy briefs that underscore the prevalence and persistence of energy insecurity using longitudinal data and describe policy pathways by the dimensions of energy insecurity- economic, physical and coping- while calling for increased public health data collection and screening in clinical settings.

Research Highlight

Approximately 28% of New Yorkers experience 3 or more indicators of energy insecurity ranging from difficulty paying bills, disconnection and using a stove for heat, to homes that are too hot, too cold and where residents underconsume energy to save on bills. Additionally, 20% of New Yorkers were impacted by electrical, heating, hot water, or gas outages of six or more hours for reasons unrelated to inability to pay. The vast majority (96%) of New Yorkers who fell behind on utility payments or who had a utility shutoff experienced at least one other form of hardship, such as trouble paying the rent or mortgage (82%), purchasing food (37%), or seeking medical care (66%).

- *Energy Insecurity Indicators Associated With Increased Odds Of Respiratory, Mental Health, And Cardiovascular Conditions* (Health Affairs, 2024)
- *A cross-sectional study characterizing the prevalence of utility service outages across demographic characteristics and health correlates in New York City* (Environmental Epidemiology, 2025*)*
- *StreetTalk: exploring energy insecurity in New York City using a novel street intercept interview and social media dissemination method* (Humanities and Social Sciences Communications, 2024)
- *Powering Up for Health Report* (E2H2 Policy Brief, 2025)
- *The prevalence and persistence of Energy Insecurity in New York City* (Robinhood Foundation Policy Brief, 2025)

This complements a larger focus on energy inequities related to power outages and the benefits and barriers to an inclusive clean energy transition in NYC.

Power Outages, Extreme Heat, and Compounding Risks

Several of our studies connect weather-induced power outages and extreme heat with acute and chronic health risks particularly in the context of historically redlined areas and in public housing communities. Our community insights on these proximal climate threats humanize and further strengthens the evidence base for modernizing energy safety nets and aligning climate adaptation strategies with health equity goals.

- *Electricity inaccessibility across historically redlined and present-day disadvantaged areas in New York City* (Journal of exposure science & environmental epidemiology, 2025*)*
- *Assessing the Burden of Electrical, Elevator, Heat, Hot Water, and Water Service Interruptions in New York City Public Housing* (Journal of Urban Health, 2024)
- *Community Insights on Weather-Induced Energy Insecurity: A Case Study of Extreme Heat and Power Outages in North Lawndale, Chicago* (Center on Global Energy Policy Report, 2025)

Equitable Decarbonization

E2H2 research has examined readiness for and barriers to clean energy adoption—including electric cooking, rooftop solar, and building retrofits—among renters and low- and moderate-income homeowners. Findings reveal how affordability, information asymmetries, housing tenure, and institutional practices shape access to clean energy technologies, with implications for equitable decarbonization.

Research Highlight

As of 2022, only 1% of New Yorkers had both solar panels and electric stoves. The majority of New Yorkers (77%) were interested in using solar but only about 5% had solar installed at their residence. Those not interested said they lacked agency, were confused about how residential solar operates, and were concerned about the cost. Most NYC residents (86%) had gas stoves, but only 14% were interested in switching from gas to electric stoves, with a preference for gas cooking most pronounced among white and higher income New Yorkers. Energy insecure residents were resistant to switching due to concerns about increased costs.

- *Readiness for a Clean Energy Future in NYC* (Energy Policy, 2024)
- *Shady Solar: Barriers to Residential Solar Adoption* (Frontiers in Energy Research, 2024)
- *Out of Gas, In with Justice* (Energy Research & Social Science, 2024)
- *When homeowners lose momentum after an energy audit: barriers to completing weatherization in the United States Midwest* (Energy Research and Social Sciences, 2025)

Ethical Innovation in Energy Systems and Energy-related Research

E2H2 has expanded its interdisciplinary portfolio through collaborative research on artificial intelligence and robotics in the building and energy sectors. As co–Principal Investigator on an AI-driven micro-retrofit initiative, we explored how drone-based building scans, ground-penetrating radar, and deep neural networks can support targeted efficiency upgrades. Our social science research examined how public servants and frontline decision-makers perceive and engage with AI tools, raising critical questions about governance, trust, and equity in technological innovation. Complementary publications have focused on AI integration in qualitative research and the opportunities-and risks- associated with data center proliferation as it relates to energy affordability.

- *Street-level Bureaucrats' Perspectives on Artificial Intelligence (AI) and Robotics Adoption: A Mixed-Methods Study of New York City's Building Sector* (AI & Society, 2026)
- *A role for Artificial Intelligence (AI) in qualitative research? An exploratory analysis examining New York City Residents' perceptions on climate change (*Sustainability, 2025)
- *How AI Growth Can Hyper-Scale Energy Equity and Affordability* (Center on Global Energy Policy, 2025)

Evaluating Policies and Informing Programs to Mitigate Energy Insecurity

Recent publications explore how federal policies—such as the Low Income Home Energy Assistance Program and expired expanded Child Tax Credit—are marked by key shortcomings considering climate change and exacerbate energy insecurity, particularly for families with children. Our peer-reviewed research is also shaping public policy and discourse including with the recent passage of NYC's Cooling requirement.

- *Heatwaves and Hardships: Enhancing the Low Income Home Energy Assistance Program to Mitigate Extreme Heat and Energy Insecurity* (Electricity Journal, 2024)

- *Expiration of the Expanded Child Tax Credit and Energy Insecurity* (American Journal of Public Health, 2025)
- *Extreme Heat and COVID-19 in New York City: An Evaluation of a Large Air Conditioner Distribution Program to Address Compounded Public Health Risks in Summer 2020* (Journal of Urban Health, 2023)

From Evidence to Action

E2H2 leads and participates in multi-institutional initiatives translating research into policy, regulatory, and community impact. Dr. Hernández offered Testimony on Energy Insecurity and Cooling Requirement at a NYC City Council Hearing for the Committee on Housing and Buildings on November 12, 2024. Intro 994-2024 requires building owners to provide cooling options (i.e., A/C units) to tenants in occupied dwellings starting June 15th to September 15th each year, upon tenant request, to maintain temperatures below 78°F, making cooling a right for renters to combat heat-related illnesses. New York City passed the cooling law in December 2025.

🔷 NEW AREAS OF RESEARCH AND POLICY IMPACT

1) Energy Insecurity and Health Over the Life Course

From the start, the links between energy insecurity and health have been a driving force of concern and innovation in our research. Recently, we have established further evidence linking energy insecurity to mental health outcomes including anxiety and depression and are developing a life course framework by which to understand the health effects of energy insecurity from pregnancy through older adulthood.

Current focus areas include childhood asthma, prenatal health during extreme heat, and chronic disease risks among older adults. In clinical settings, we have secured pilot funding to explore the links between energy insecurity including power outages and asthma outcomes (with co-PI Dr. Stephanie Lovinsky-Desir) and assess it as a risk factor in pregnancy, an effort stewarded by E2H2 team member, **Dr. Qian Li**. In community settings, we are examining energy insecurity and cardiovascular health in older adulthood as well as how it serves as a compounding health hazard for the elderly in studies shepherded by E2H2 team member, **Dr. Felipe Antequera**. These pilots and applied studies translate epidemiologic insights into actionable strategies to better understand how energy insecurity shapes health.

Research Highlight

Energy insecurity functions as a distinct and consequential social determinant of mental health. Across all indicators, households experiencing energy insecurity showed substantially higher probabilities of anxiety and depression, even after adjusting for income, food insecurity, and demographic characteristics. Behavioral and physical responses to energy insecurity—keeping the home at unsafe temperatures or forgoing food or medicine to pay an energy bill—were more strongly associated with adverse mental health than the economic indicator of being unable to pay a bill in full. In fact, forgoing basic necessities had the strongest relationship to mental health, exceeding even the effects of food insecurity and underscoring that trade-offs driven by energy hardship can be uniquely destabilizing. While the probability of poor mental health declined with rising income, higher-income households experiencing energy hardship still showed elevated anxiety and depression rates.

- *Energy Insecurity and Mental Health: Exploring the Links Between Energy Hardships and Anxiety and Depression* (Sustainability, 2025)
- *Energy Insecurity and Cognitive Function: A Preliminary Analysis of the Offspring Study* (Innovation in Aging, 2025)
- Electrical power outages and asthma-related emergency department visits in New York City, 2019-2022 (In progress)

Relevant Projects:

Bronx Neighborhood Redevelopment and CVD in mid-life and older adults
Funder: National Institutes of Health/ National Heart, Lung, and Blood Institute (NHLBI)
Description: This study evaluates the impact of a redevelopment initiative in the Bronx, NY on CVD-related health outcomes.

Addressing Intersecting Crises: Climate, Housing, and Compounding Health Vulnerabilities for Senior Tenants
Funder: New Frontiers in Research Fund, via The Social Sciences and Humanities Research Council (SSHRC), Canada
Description: This interdisciplinary project aims to address the intersection of environmental health and climate justice by studying the indoor environments of senior tenants' homes in major coastal urban centers like Barcelona, New York City, and Vancouver. Through initiatives such as measuring indoor environmental quality, implementing communal 'climate safe' rooms, monitoring policy implications on tenancy, and identifying mechanisms for climate-related rent increases or displacement, the project seeks to foster equitable climate action and support community-based climate resilience measures.

2) Energy Insecurity in New York State

Building on our cutting-edge research in NYC, we have recently been funded by the New York State Energy Research and Development Authority (NYSERDA) to examine energy insecurity and related inequities at the state-level and stewards a network of researchers and community groups seeking to advance knowledge in these areas.

Relevant Projects:

Characterizing Energy Insecurity and Energy Inequities Across New York State
Funder: The New York State Energy Research and Development Authority (NYSERDA)
Description: This project aims to: 1) conduct a scoping review to document the current state of knowledge on energy insecurity and concepts related to energy inequities and identify gaps to be filled in future research; 2) leverage existing data to describe energy insecurity and energy inequities in NYS; 3) develop a model based on key metrics to understand distributive elements and evaluate knowledge gaps and areas of uncertainty that can be addressed to improve modeling efforts; 4) field a statewide, longitudinal survey based on a validated instrument administered over 6 waves to characterize energy insecurity and refine modeling techniques with improved data; and 5) extend prior aims by collecting complementary data using qualitative methods, case studies, utilizing robust environmental and utility data and exploring health associations.

Researching Energy Insecurity: A working Group and action Network (REIGN)
Funder: The New York State Energy Research and Development Authority (NYSERDA)
Description: This project establishes a statewide working group and action network on Energy Insecurity (REIGN) to address gaps and opportunities in community partner building.

3) City-level Solutions to Reduce Energy Insecurity

With funding from the Alfred P. Sloan Foundation, we have launched a pilot initiative entitled, Cities Uniting to Reduce Energy Insecurity (CUREi) which leverages our prior work in NYC and Maricopa Count. CUREi seeks to establish a network of cities to explore energy insecurity mitigation strategies, while our ongoing collaboration with partners in British Columbia and Barcelona offer the opportunity to apply our methods in internationally.

- *Prevalence of Energy Burden in a South Phoenix Community and Implications for Public Health* (Environmental Justice, 2025)

Relevant Project:

Cities Uniting to Reduce Energy Insecurity (CUREi): A Network for Research Translation and Local Action

Funder: Alfred P. Sloan Foundation

Description: The CUREi project seeks to harness city-specific competencies by building a focused network of urban centers, starting with three pilot cities – New York City, Denver, and Atlanta. By tapping into local governance strengths— such as access to impacted populations, agile public policy mechanisms, and the ability to integrate data collection and stakeholder engagement—the initiative aims to build capacity through network development, provide evidence- based tools, resources and technical assistance to network members, and identify research and pilot project opportunities that can be implemented in the next phase through city-academia collaborations.

4) Upstream Solutions: Policy, Regulation & Energy Affordability

A central pillar of E2H2's most recent work in conjunction with the Energy Opportunity Lab, also co-Directed by Dr. Hernández, focuses on upstream policy solutions—especially utility ratemaking and regulatory processes—as levers to prevent energy insecurity. Recent scholarship, commentaries, and factsheets advance evidence-based approaches to electricity affordability, equitable rate design, and meaningful public participation in regulatory proceedings.

We are further advancing this work with a new study led by E2H2 team member, **Dr. Yutong Si**, funded by NYSERDA which is applying advanced computational methods to examine regulatory proceedings from an energy justice lens.

Research Highlight

This **study** examines how electricity pricing interacts with structural racism to shape racial disparities in energy insecurity. The authors analyze utilities in Alabama, California, and New York, linking energy rates, consumption, and billing data with demographic profiles of utility service areas. They find that customers in predominantly Black, Indigenous, and Latino communities pay higher energy prices but consume less electricity compared to customers in majority white areas. These disparities persist across different types of utilities, with investor-owned utilities often charging the highest rates. The results suggest that energy pricing operates as an upstream contributor to racial inequities in energy insecurity, alongside known pathways such as housing conditions and income inequality.

- *Addressing Energy Insecurity Upstream: Equity in Electric Utility Ratemaking and Rate Design* (Energy Law Journal, 2024)

- *Race, Rates, and Energy Insecurity: exploring racial disparities in electricity costs and consumption in U.S. utility service areas* (Scientific Reports, 2025)
- *Centering Electricity Affordability in the Utility Ratemaking Process* (CGEP *Event Summary*, 2025)
- *30 years after Chicago's deadly heatwave, cooling should be recognized as a right* (Utility Dive Op-Ed, 2025)
- *Utilities' Low-Income Discount Programs Help Address Energy Insecurity, But Some US States Lag Behind* (CGEP BlogPost, 2024)
- *Addressing Energy Insecurity via Utility Ratemaking* (CGEP *Fact Sheet*, 2024)
- *Utility Policies and Practices to Alleviate US Energy Insecurity* (CGEP Commentary, 2024)

🔷 TEACHING, TRAINING & MENTORSHIP

E2H2 integrates teaching and mentoring at through direct instruction in interdisciplinary courses across public health, sustainability, social work, journalism, and climate science at Columbia and other institutions. We are also committed to training the next generation of energy equity researchers, practitioners and leaders as a placement site for undergraduate research and via our extensive lineup of graduate-level research assistants, doctoral trainees and postdoctoral scholars. A course co-designed and co-taught by Dr. Hernández with Dr. Lynnette Widder, entitled "Equity, Energy and the Built Environment" has featured guest lectures from E2H2 members Yutong Si, Felipe Antequera, Vivek Shastry and Qendresa Krasniqi.

🔷 PUBLIC SCHOLARSHIP & COMMUNITY ENGAGEMENT

Extending the Reach of Research Insights | Strategic Dissemination and Public Engagement
Through books, peer-reviewed articles, public facing reports and commentaries, blogposts and op-eds and hundreds of speaking engagements, E2H2 ensures that research insights shape public understanding and real-world decision-making. The publication of *Powerless* and its national and international book tour amplified public understanding of energy insecurity as a civil rights, health, and climate issue. Events included keynotes, book talks, and community conversations across the U.S. hosted by dozens of high-profile and local organizations.

Our comprehensive media presence-both earned and created, showcases our commitment to reaching widespread audiences and being sought after as a thought leader. Dr. Hernández has been featured as a commentator in the *NY Times*, *NPR*, *Washington Post*, *The Guardian*, among other news outlets.

E2H2 continues to lead innovative public education **@HotandCold_NYC** social media campaign exposes the faces and places of energy insecurity in NYC and beyond and has reached more than 500,000 views and impressions since being launched in July 2023. Our marquee annual event, *Power Uptown*, which launched during Climate Week 2024, seeks to engage local community members in energy and climate knowledge and access to resources. Our team created a **short documentary**, featuring compelling accounts of the lived experience of energy insecurity, was selected for viewing at the American Public Health Association's *Health Film Festival* (Annual Conference, 2025).

🔷 HONORS AND RECOGNITION

Recent honors reflect the growing impact of E2H2's work, including national fellowships, leadership awards, and recognition for scholarship, service, and public engagement in climate justice and energy equity. For the 2025-2026, Dr. Hernández was invited to be a *Climate* Justice Fellow at Harvard University's Radcliffe and Salata Institutes. She was also named a *University Fellow* at Resources for the Future (2025-2028), having previously been a *Climate Policy Fellow* at the Roosevelt Institute (2023-2025), a *Visiting Scholar* at the Russell Sage Foundation (2021-2022), and a *JPB Environmental Health Fellow* at the Harvard Chan School of Public Health (2014-2017), where she stayed on as a part of the leadership team (2021-2026). Dr. Hernández received the *Leadership and Service Award* from WE ACT for Environmental Justice (2025), the *Public Health Catalyst Award*, from Boston Congress of Public Health (2022), recognition as a *Distinguished Alumni* from Hunter College (2022), induction into the *Academy of Community and Public Service* at the Columbia University Irving Medical Center (2023). She also served as a *Mayoral Appointee* to the New York City Environmental Justice Advisory Board (2019-2024) and received a *Public Health Service Award* from the New York League of Puerto Rican Women (2019).

Yutong Si is an ABF/JPB Access to Justice Research Initiative Early Career Scholar and presented her research at the National Academies' Understanding and Addressing Energy Affordability: A Research Workshop, February 2025.

🔷 LOOKING AHEAD

E2H2 is poised to deepen its impact by expanding applied policy research, strengthening community-government-academic partnerships, and supporting scalable solutions that align climate action with health equity. Continued investment will accelerate the translation of evidence into systems-level change. In the coming years, E2H2 will extend its partnerships, expand applied policy research, and continue advancing the recognition of household energy as foundational to health, dignity, and climate resilience. We invite collaborators, students, policymakers, and community partners to stay engaged and join us as we work together toward more just housing and energy futures.

Join our **Team**! Support our mission- **Donate Today!**