

Energy Justice for Detroit

NSF Smart & Connected Communities Project: Reducing Barriers to Residential Energy Security through an Integrated Case-management, Data-driven, Community-based Approach

UM Anti-Racism Grant: Enhanced Energy Monitoring for Energy Justice in Detroit

Principal Investigators

Johanna Mathieu, College of Engineering
Carina Gronlund, Institute for Social Research
Marie O'Neill, School of Public Health
Shelie Miller, School for Environment and Sustainability
Tony Reames (on leave), School for Environment and Sustainability

Community Partners

Gibran Washington, EcoWorks
Rebecca Nikodem, Jefferson East, Inc.
Zachary Rowe, Friends of Parkside
Raquel Garcia, SW Detroit Environmental Vision
Sarah Clark, SW Detroit Environmental Vision

Other Partners

Rachel Jenkins, Pecan Street Inc



Outline

- Energy Justice
- Inequity in Detroit
- Project Overview
- Technical Topics (Research in Progress!)
- Concluding Thoughts

Energy Justice (different than “Energy Equity”)

“Energy justice refers to the goal of achieving equity in both the social and economic participation in the energy system, while also remediating social, economic, and health burdens on those historically harmed by the energy system (“frontline communities”). Energy justice explicitly centers the concerns of marginalized communities and aims to make energy more **accessible, affordable, and clean** and democratically managed for all communities.”



Initiative for Energy Justice, “Section 1 – Defining Energy Justice: Connections to Environmental Justice, Climate Justice, and the Just Transition,” <https://iejusa.org/section-1-defining-energy-justice/>,

What is Energy Justice?



Distributive
Equitable allocation of
benefits and burdens



Procedural
Fair access to process



Recognition
Acknowledgement of and
respect for all peoples



Restorative
Addresses issues of past
harms



Cognitive Justice
Recognizes the right for
different understandings and
ways of life to coexist





Vacant Land

■ Structure-free parcel

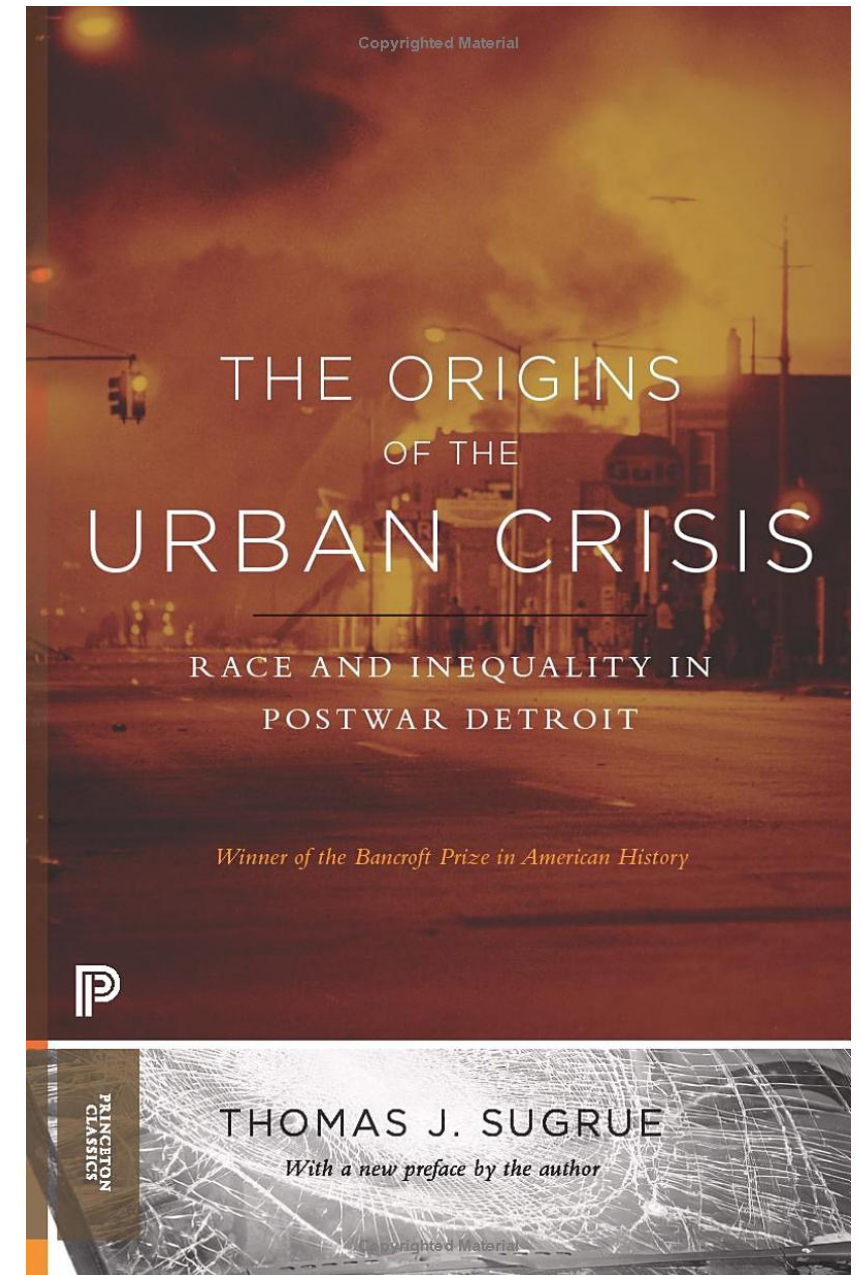
1 2 4 miles

Source: Detroit Future City.

N

Detroit

- Detroit's population shrunk from its high of 1.85 million (1950 census) 630,000 (2021).
- Detroit is one of the top ten highest energy burdened metro areas in the US.
 - **Energy burden:** % of household income spent on energy
- Detroit low-to-moderate (LMI) households spend 15-30% of their income on energy (6% or less is considered affordable).



Disparities in Metro Detroit

“...coal-fired power plants are disproportionately located in communities of color.”

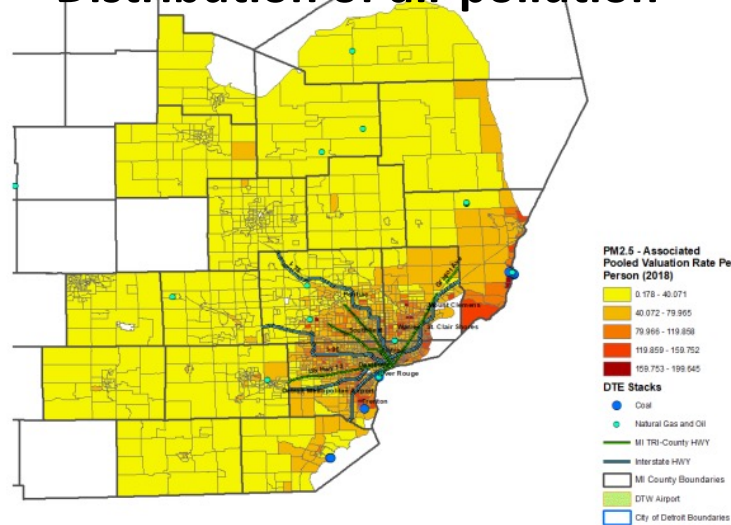
“...high household energy burdens, low residential energy efficiency, and extreme heat exposure are concentrated in the same census tracts that are more exposed to DTE air pollution.”

N. Ignaczak, “MPSC considers requiring utilities to account for public health costs of future electricity generation”, *Planet Detroit*, May 7, 2021.

<https://planetdetroit.org/2021/05/mpsc-considers-how-to-account-for-the-inequitable-public-health-costs-of-future-electricity-generation/>

Based on research by Amy Schulz and Tony Reames (UM)

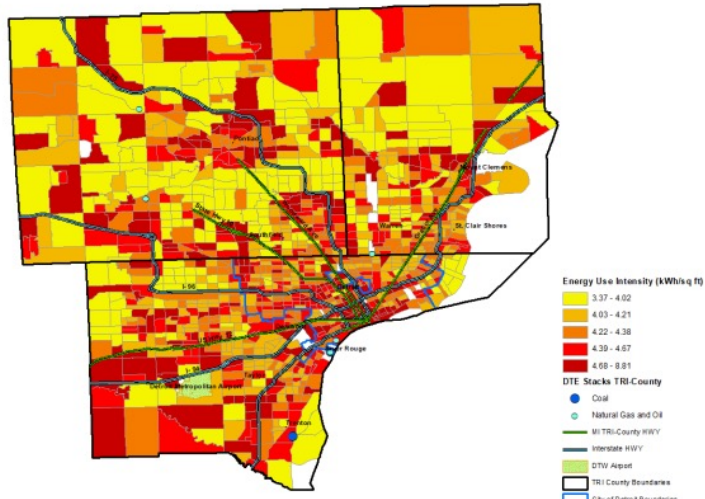
Distribution of air pollution



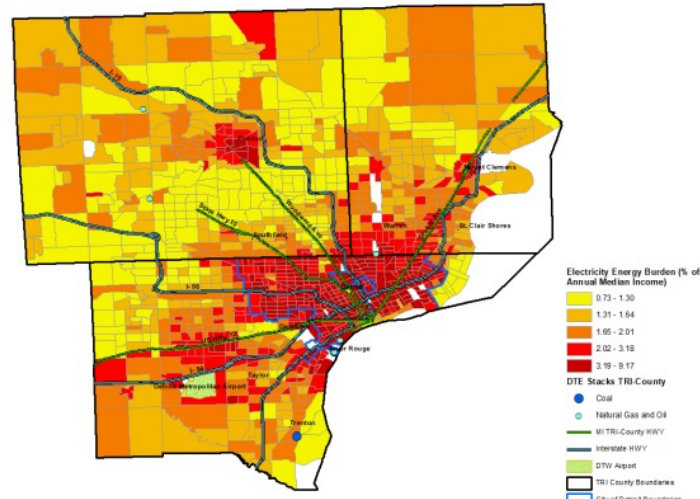
People Of Color



Distribution of EUI



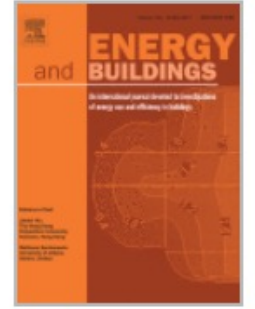
Distribution of energy cost burden






Energy and Buildings

Volume 143, 15 May 2017, Pages 25-34



The intersection of energy and justice: Modeling the spatial, racial/ethnic and socioeconomic patterns of urban residential heating consumption and efficiency in Detroit, Michigan

[Dominic J. Bednar](#)  , [Tony Gerard Reames](#) , [Gregory A. Keoleian](#) 

Detroit communities we're working with

Villages at Parkside

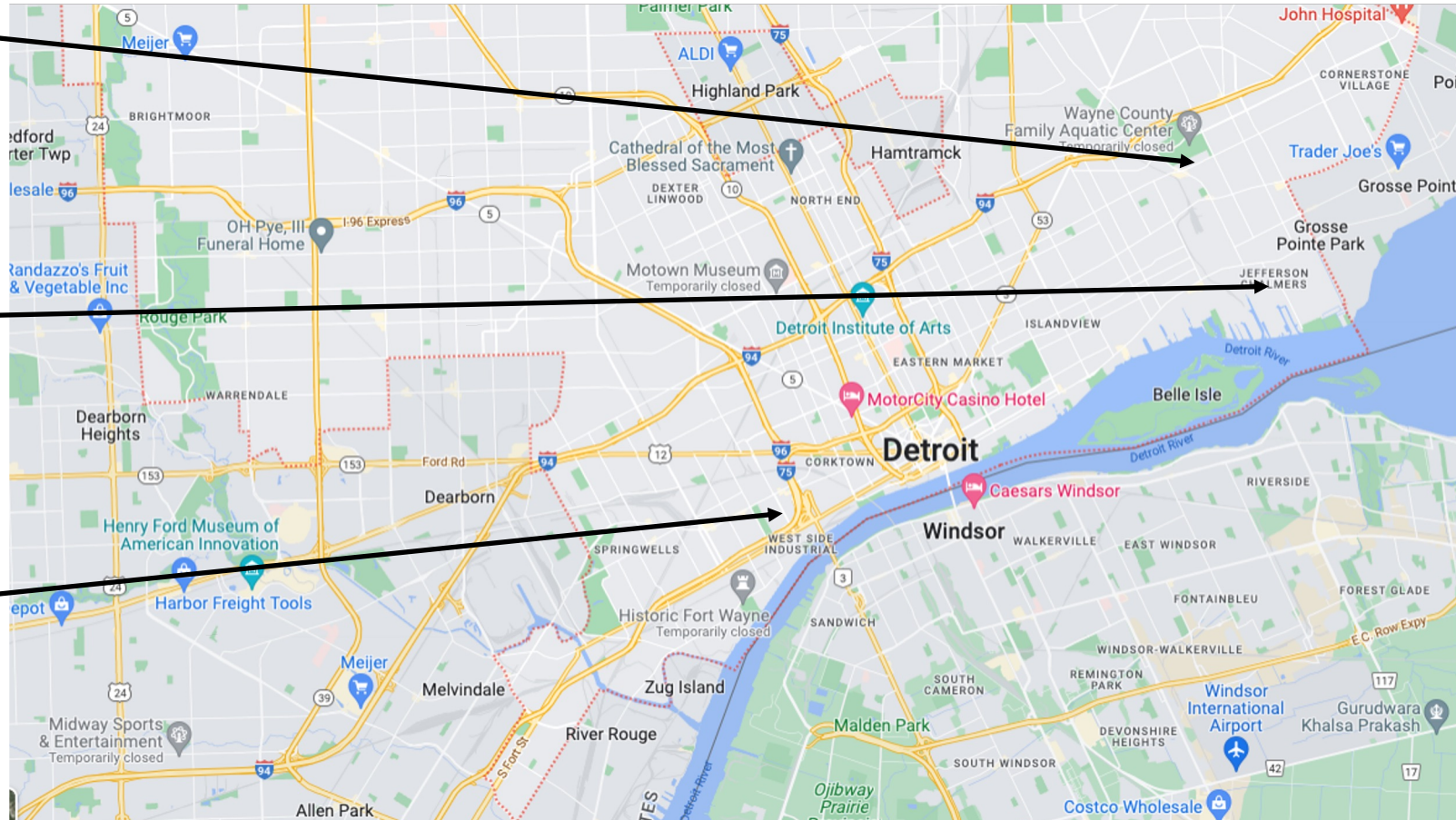
- Predominately Black, renters
- Median household income: \$11,909
- % below poverty line: 82.5%

Jefferson Chalmers

- Predominantly Black, homeowners
- Median household income: \$28,117
- % below poverty line: 39.3%

Southwest Detroit

- Predominantly Latinx, homeowners
- Median household income: \$26,670
- % below poverty line: 42.4%



Project Overview

Project goal: reduce energy burden (% of household income spent on energy) and/or improve home comfort and health outcomes in low-to-moderate income (LMI) households in three Detroit neighborhoods



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→ Founded UM
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Partners



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Zachary Rowe

Friends of
Parkside



Gibran
Washington

EcoWorks



Nico Hill
Jefferson East
Inc.

& MaryCruz Gutierrez

Partner Organizations

- **Southwest Detroit Environmental Vision:** nonprofit whose mission is to improve the environment and strengthen the economy of Southwest Detroit through the partnership with residents, community organizations, government agencies, schools, businesses and industry to combat environmental issues, including air quality, blight (illegal dumping, graffiti, abandoned homes), and incompatible land use.
- **Jefferson East Inc:** nonprofit organization, partners with neighborhood residents and businesses to support development, greater resources, and investments. The Housing Service team provides housing support and linkages for residents to city, state and federal programs & resources designed to sustain the communities we serve.
- **Friends of Parkside:** nonprofit, community-based organization that concerns itself with the health, education and safety of the residents that live in Village at Parkside (public housing).
- **EcoWorks:** nonprofit that creates just, equitable, and inclusive solutions to climate change and other community sustainability challenges. Eco-D provides residents and community organizations with resources to achieve healthy, affordable, resilient, and energy secure homes and neighborhoods.



Students



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Electrical
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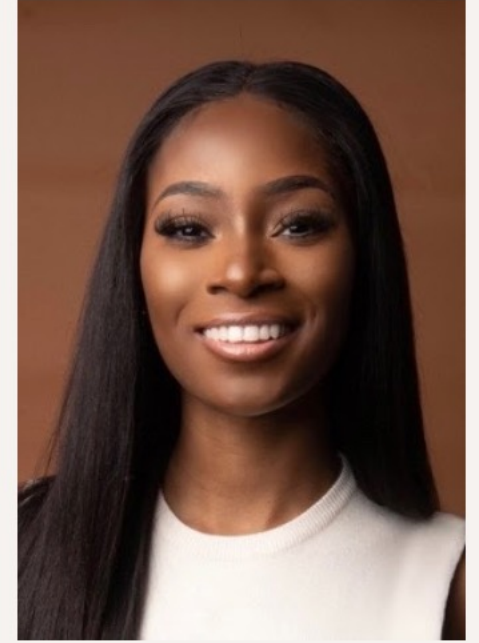


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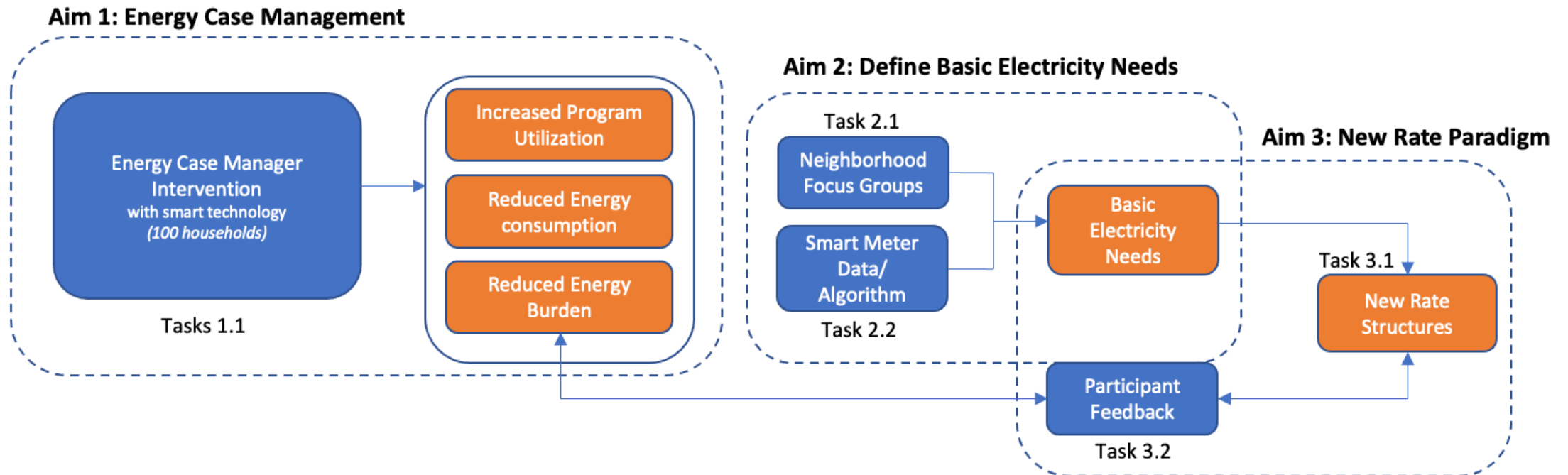
Project Overview

Energy case managers create household-specific energy improvement plans based on

- smart meter data + electricity submetering data
- house/household characteristics acquired through in-person visits

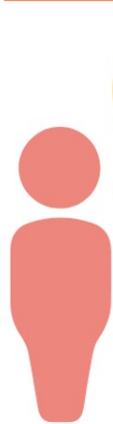
Research questions

1. How effective are energy case managers at increasing access to assistance/utility programs, improving home efficiency, reducing energy burden, and/or improving home comfort and health outcomes?
2. How can we quantify households' basic electricity needs?
3. How can we design new electricity rates to better subsidize basic electricity needs?



Energy Case Manager Intervention

Jefferson Chalmers home owners:



1 Do you ever have trouble paying your utilities or wonder if you could save some energy or pay less?

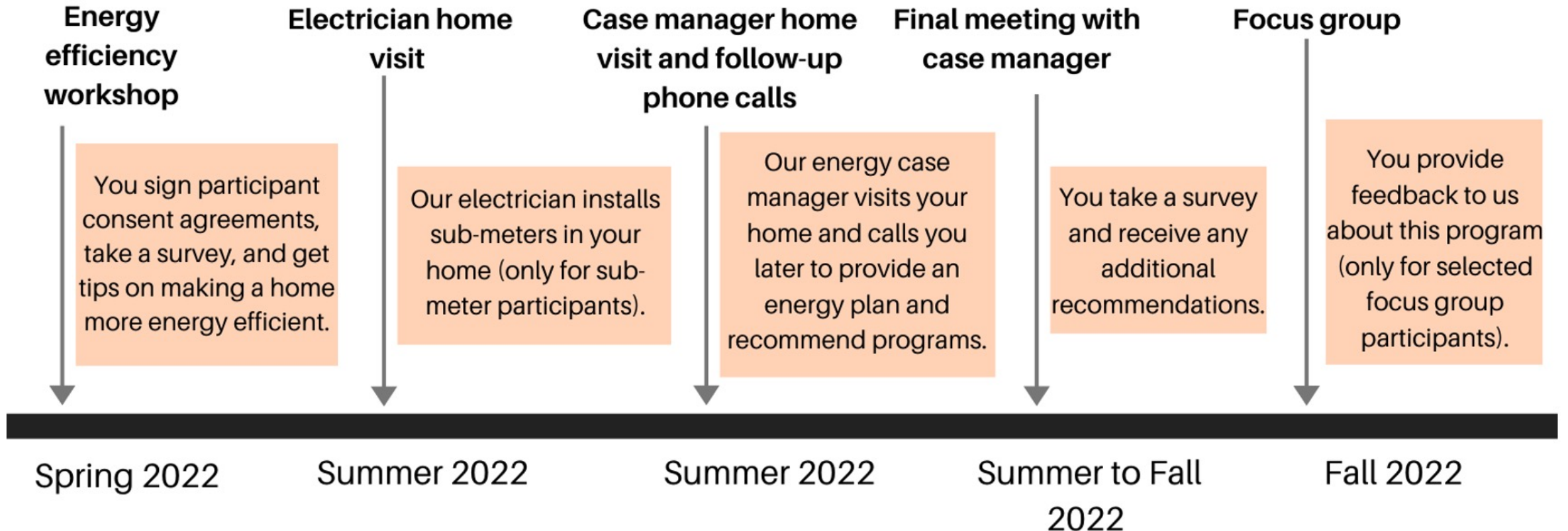
2 Would you like to learn more about existing energy efficiency and rate programs and discover an energy improvement plan based on your family priorities?

Participate in a study on saving energy, reducing costs, and/or improving the comfort of homes with an energy improvement plan and receive \$180.

You may also be selected to have sub-meters installed to measure energy usage in more detail and receive an extra \$50 and/or be in a focus group for an extra \$25.

Energy Case Manager Intervention

Timeline:



Recruiting 100 Households



Jefferson East Inc Neighborhood Resources Hub

- Human Subjects / IRB approvals
- Recruiting workshops
 - Informed consent
 - Energy efficiency workshop
 - Utility data release

Installing Electricity Submetering

Submeters (eGauges) collect electricity consumption data from individual circuits in a house at 1 sec intervals → we can analyze the consumption of major appliances and groups of smaller appliances

- Helps us to create better energy improvement plans
- Helps us validate our approaches to disaggregate smart meter data, which are needed when electricity is not submetered



Submetering data are anonymized and added to the **Pecan Street Dataport**, the world's largest resource for residential energy use data.



<https://www.pecanstreet.org/dataport/>

- Previously Dataport included few LMI or otherwise underrepresented homes
- Anonymized data is available to the international research community

Conducting Home Visits

Section 1 of 20

Energy Case Manager Data Collection Sheet

Please answer questions to the best of your ability with the assistance of the resident if needed.

What is the participant's name?

Short answer text

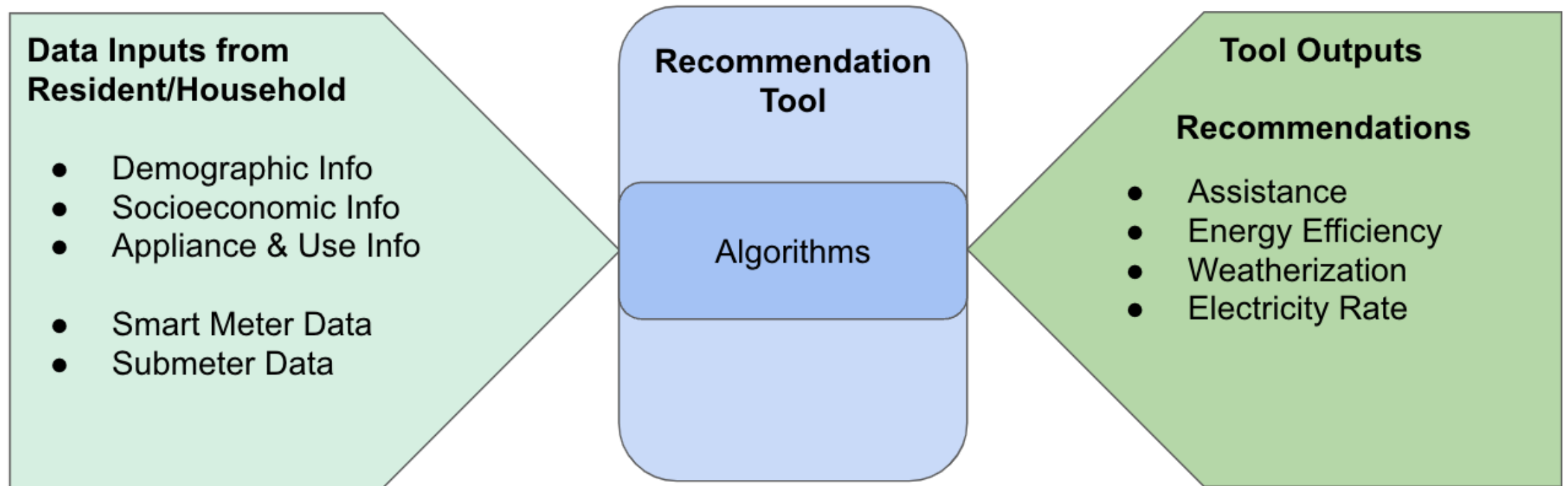
What is the participant's address?

Short answer text

Creating Energy Improvement Plans

Energy Improvement Plans outline data-informed intervention strategies meant to reduce energy burdens, improve energy efficiency, and increase home comfort for low-to-moderate income households in Detroit.

Intervention strategies including behavioral changes, program/rate plan enrollment, appliance replacement/repair, that Energy Case Managers recommend



Energy Case Manager Make Follow-up Calls

[in progress!]

Challenges!

- COVID
- PI departure
- DTE default rate change!
- Training energy case managers; and re-training...
- Trust → Attrition?

Dr. Tony G. Reames is the Principal Deputy Director for the Office of State and Community Energy Programs. He was most recently the Department of Energy's Deputy Director for Energy Justice, where he stood up the Department's new Office of Energy Justice Policy and Analysis in the Office of Economic Impact and Diversity. Reames also served as a Senior Advisor on Energy Justice.



DTE Energy's new time-of-day rates take effect. Here's what they mean for customers.

Updated: Mar. 01, 2023, 9:55 a.m. | Published: Mar. 01, 2023, 9:42 a.m.



Technical Topics

Leveraging a wealth of data:

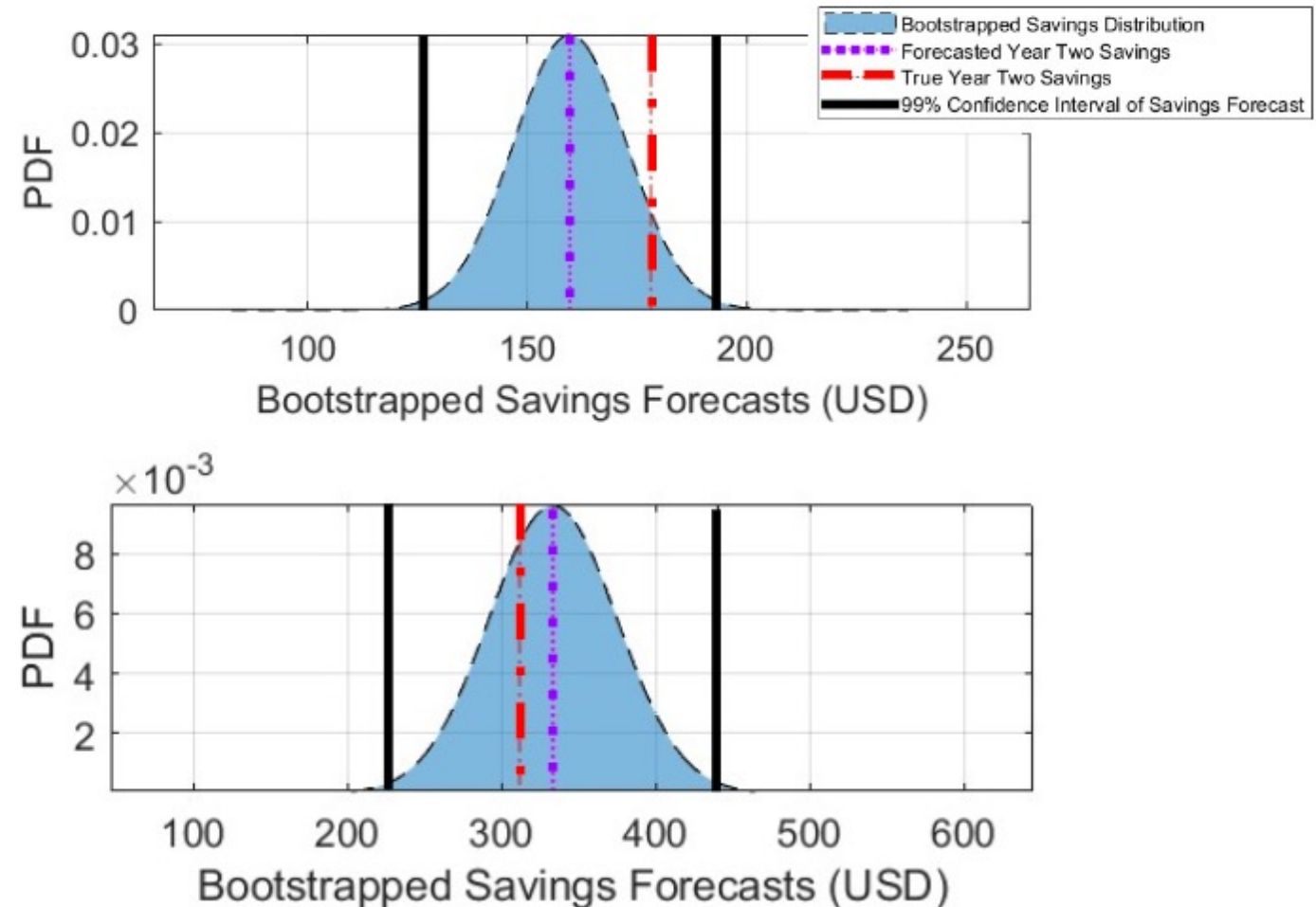
- Details info about participant homes and appliances
 - Recorded by energy case managers...
- Two years of hourly smart meter data
 - backfilling...
- 1 second interval P, Q, V, THD, ... by home circuit
 - few circuits/home, some poorly labeled, mismatch

Topic 1: Rate plan recommendations + confidence

Xavier's talk yesterday!

→ We need to ensure rate plan recommendations come with a high level of confidence that the homeowner will save money

Two examples of bootstrapped savings distributions compared to true savings

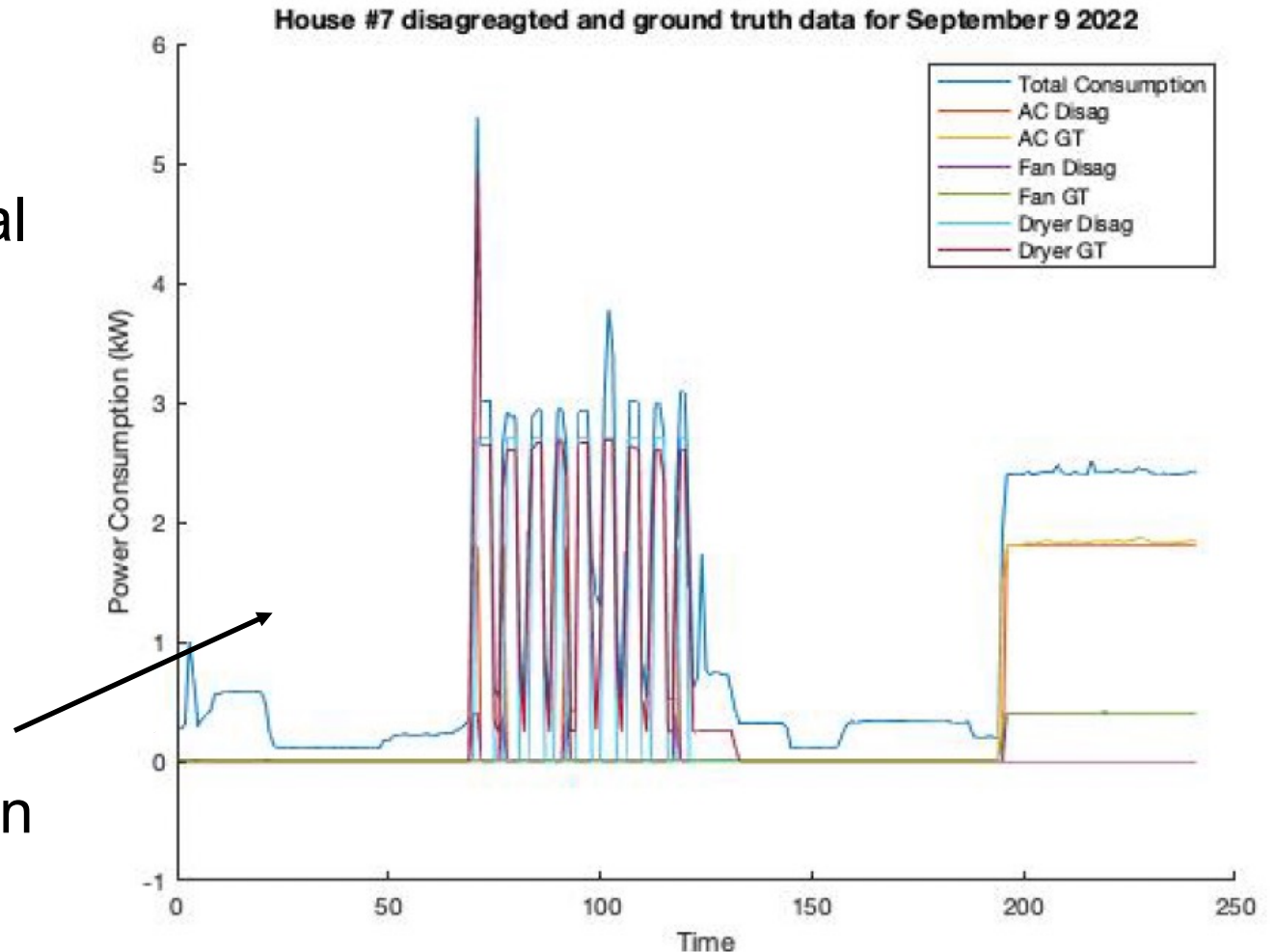


Topic 2: Non-intrusive load monitoring to estimate load flexibility

If the energy case manager only had smart meter data, how could they generate appliance-specific behavioral change recommendations?

- Disaggregate smart meter data
- Estimate flexibility of appliances

Early optimization-based disaggregation results and comparison to submetering ground truth



Topic 3: Decarbonization of LMI homes

Collaboration has led to identification of new research with community partners...

Pain point:

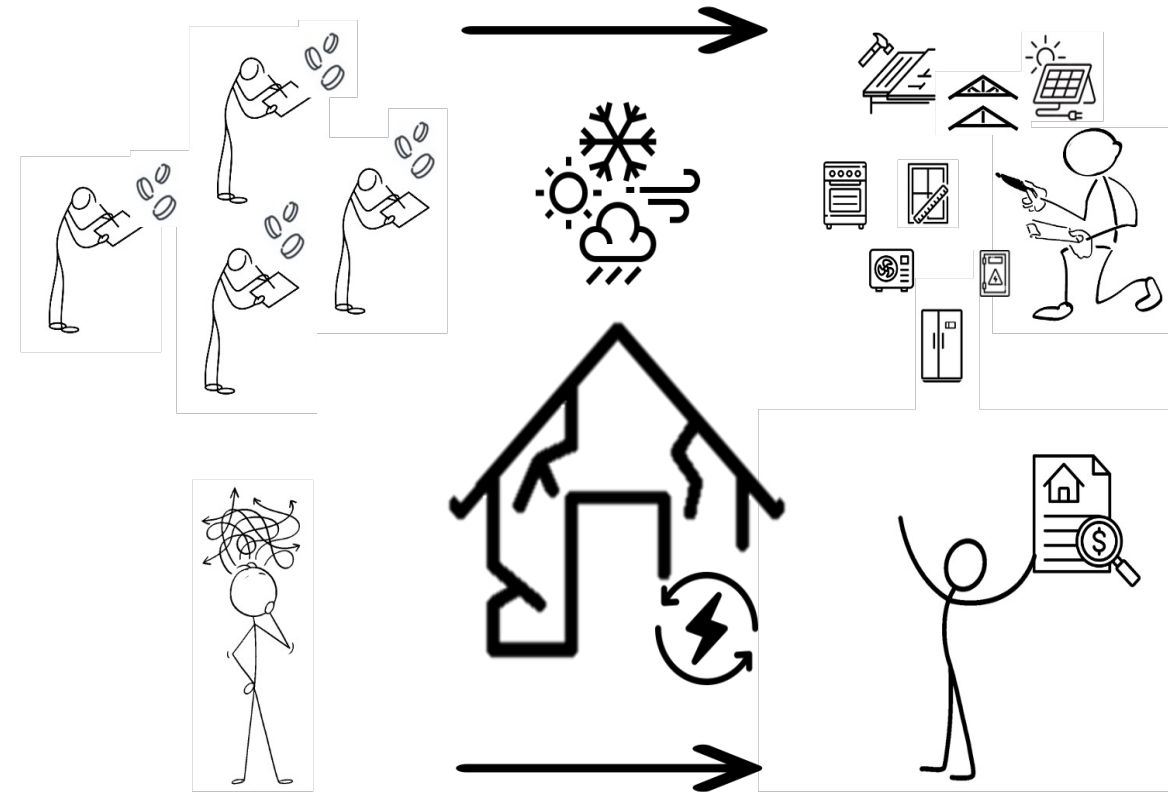
- complex labyrinth of assistance, financing, and incentive programs designed to promote housing and energy security
- energy case managers may have to conduct separate home visits and/or assessments for each program

Solution:

- development of a common home assessment
- “decarbonization-ready”

→ NSF CIVIC planning grant (6 month; \$50k)

→ NSF CIVIC project proposal in review (1 year; \$1M)



Topic 3: Decarbonization of LMI homes

Leverage participant data to determine decarbonization pathways for LMI homes via...

- Home modeling and simulation
- Decarbonization (e.g., appliance electrification) affordability assessment given appliance usage along with available assistance, financing, and incentive programs
- Leveraging electrified appliances for grid flexibility to improve affordability

→ How do we ensure grid flexibility from LMI homes is harnessed in a way that is equitable and just?

[GRID-BAL (R&D 100 Award) + Equity?]

Concluding Thoughts



Concluding Thoughts

- Highly-interdisciplinary work is hard.
- Real-world interventions take a long time.
- Working with community partners is simultaneously challenging + rewarding.
 - “Cultural Competence”
 - Differing priorities (e.g., flooding, solar PV!)
- Trust is critical.