Nock IRWG Recommendations based on the Near-Term Report

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Executive Summary

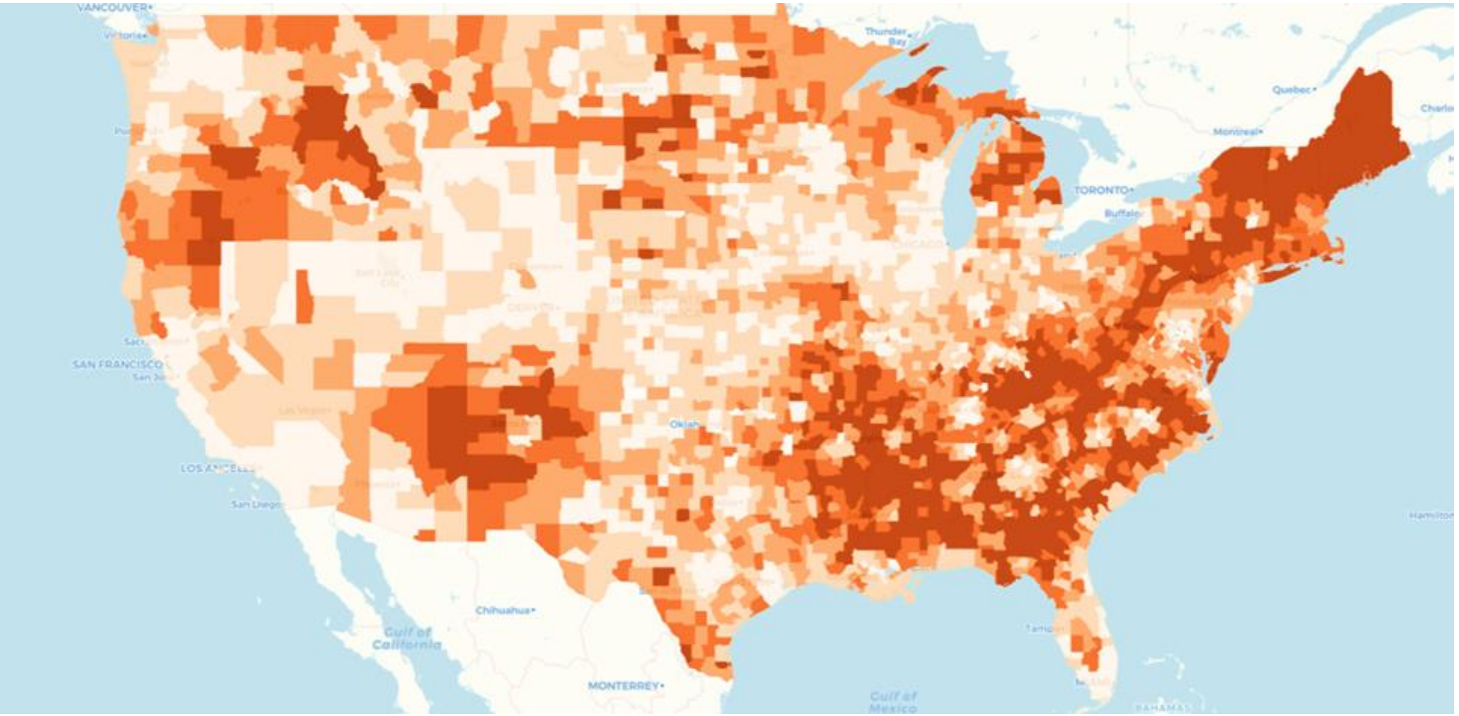
I reviewed the Near-Term Rate Strategy Report, focusing on its structure around energy rates and the identified potential impact on diverse households. Based on my assessment, I have several recommendations to ensure that the Near-Term Rate Strategy adequately addresses energy affordability, protects vulnerable groups, and incorporates a more data-driven and holistic approach.

Overview of Recommendations

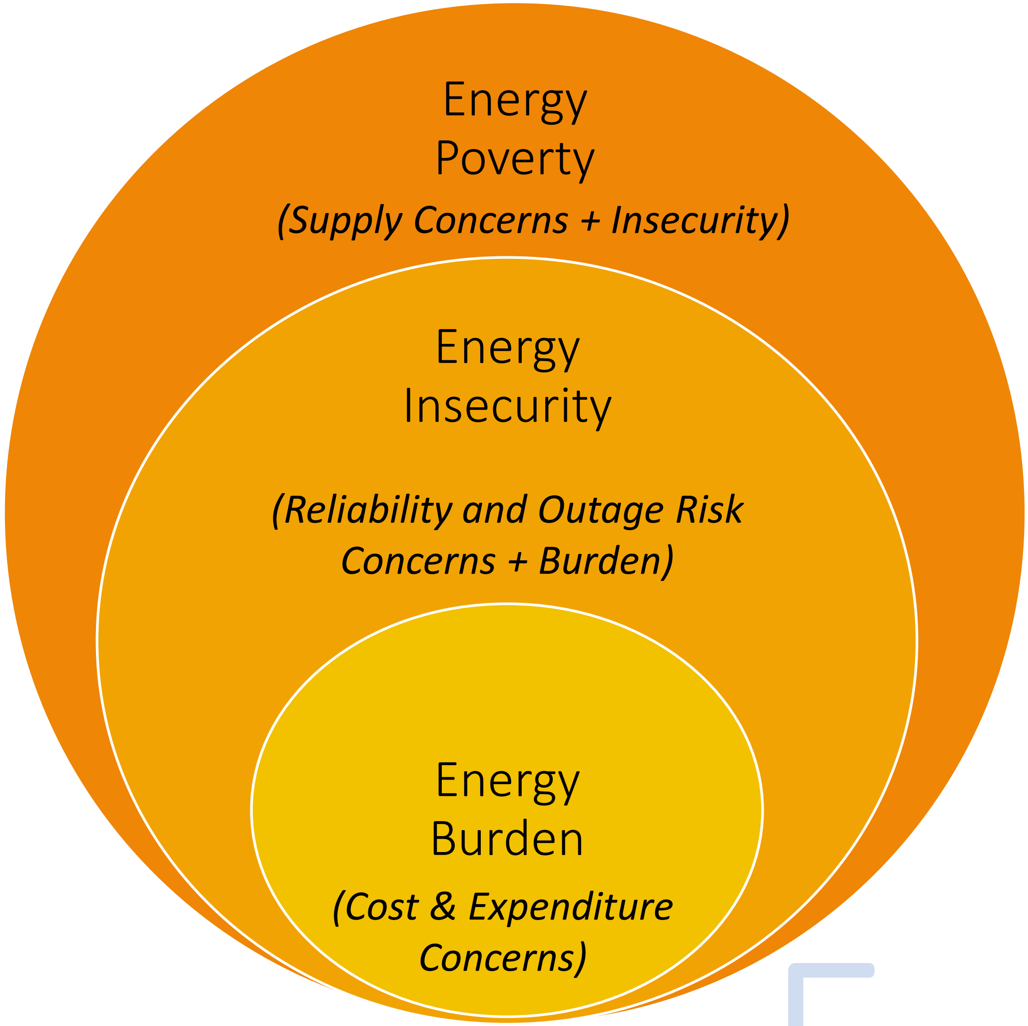
1. **Inclusion of a Clear Definition of Energy Affordability**
2. **Increased Demographic Designations**
3. **Enhanced Data-Driven Methods to Assess Rate Impacts and Target At-Risk Customers**
    - **Protections for Low- and Moderate-Income Households**
4. **Holistic View of Housing-Related Energy Burdens**
5. **Integrated Approach for Supporting At-Risk Customers**
6. **Support for Upfront Costs of Fuel Switching**

1. Why do We Need a Definition of Energy Affordability

Energy poverty in the US



Energy burdens (at the county level) for LMI (low and moderate-income) households. The lightest color in the choropleth scale is <6% of annual income spent on housing energy bills, and the darkest is >19%.
https://blog.ucsusa.org/joseph-daniel/how-to-make-energy-burden-less-bad

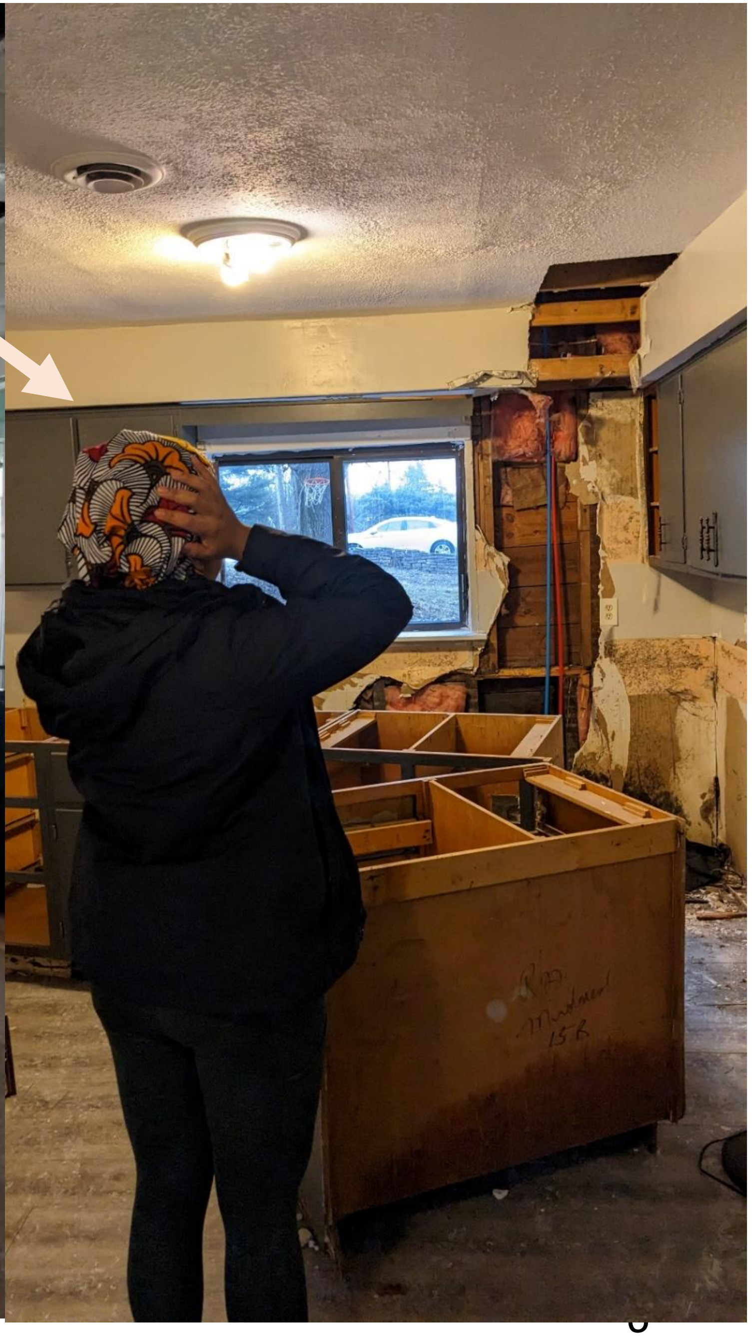


How Many People Have Experienced Pipes Freezing in your Home because you (or someone you know) was trying to save money on the heating bills?

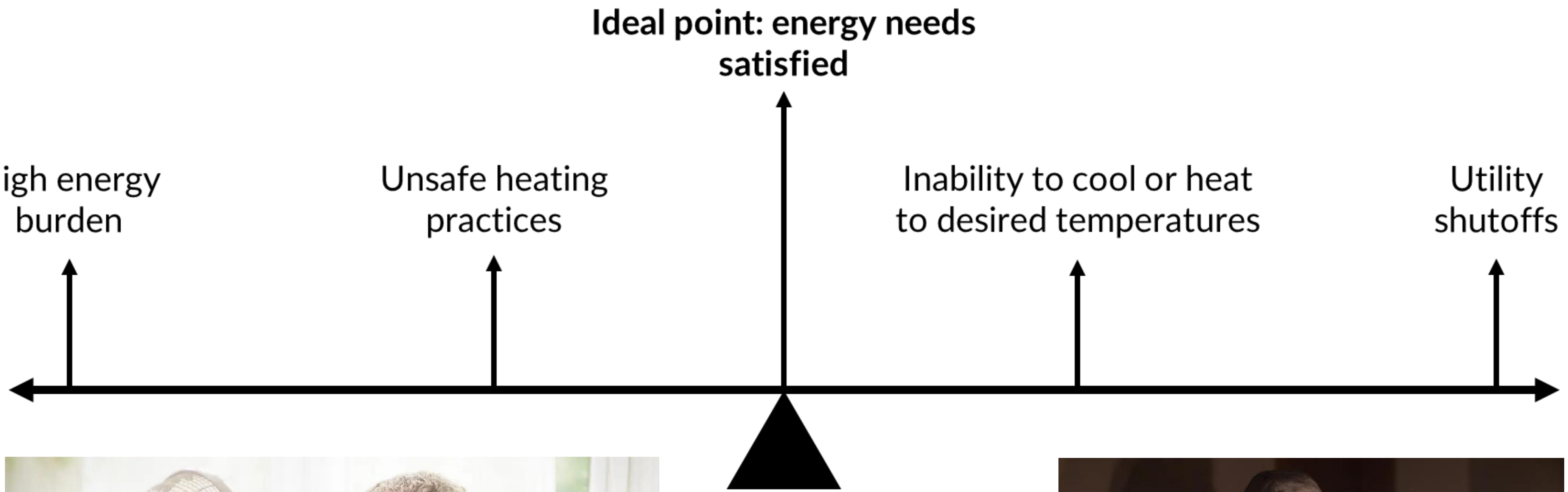
2022 Christmas cold snap led to the entire duplex losing access to water

That’s me ☹

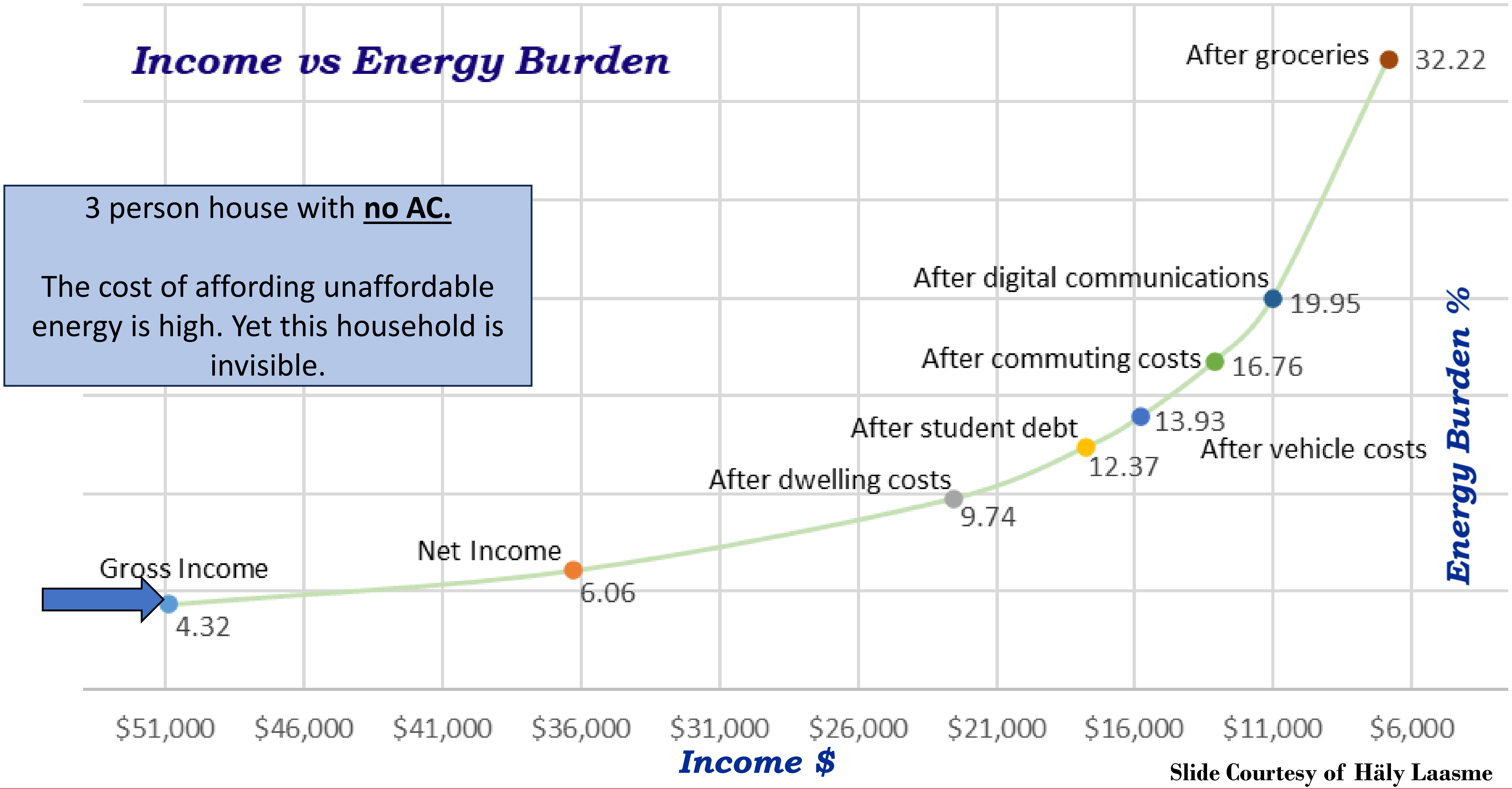
(My tenant trying to save money on bills led to big consequences)



Tradeoff between energy and other necessities



Energy Burden misses the big picture and true fraction



Slide Courtesy of Häly Laasme

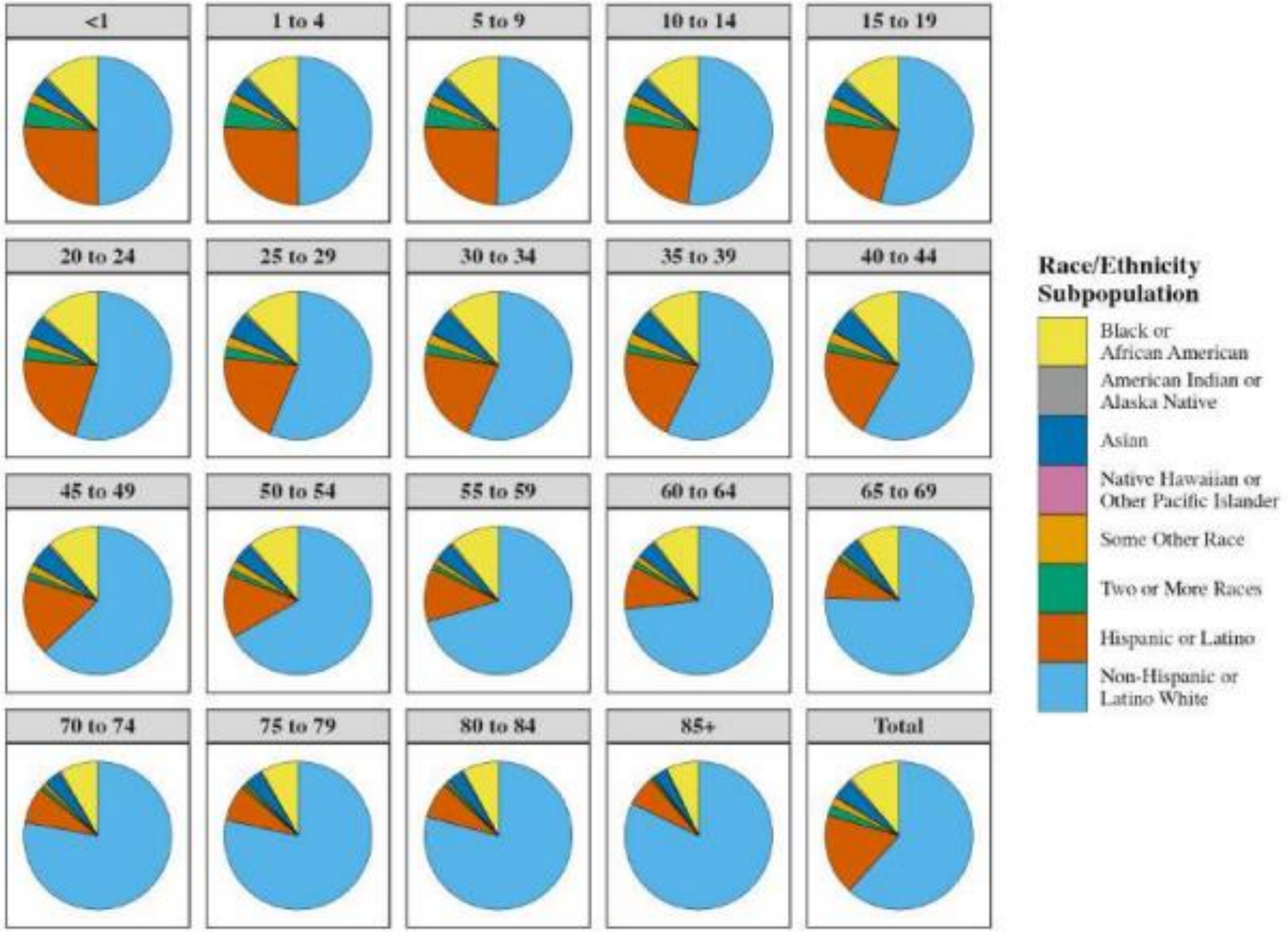
1. Clear Definition of Energy Affordability

- Energy affordability is the ability of households to access reliable and sufficient energy services without compromising their financial well-being.
- It encompasses energy costs, energy usage, efficiency, access to modern energy technologies, and the influence of policies and rate structures.

2. Why Should We Increase Demographic Designations

- Currently the analysis focuses on analyzing rate impacts across income and housing types.
- What is the risk of ignoring age and race interactions?

In Older Populations Minorities are Not As Prevalent



Sources: Population data are from the U.S. Census Bureau [66].
Notes: Data characterize 2017. Age subgroup population breakdown by race/ethnicity considering totals across CONUS. Subpopulations are defined by the U.S. Census Bureau (see Supplementary Table 8). All race/ethnicity groups are adapted to be mutually exclusive. Hispanic is Hispanic or Latino ethnicity, comprised of any racial group. Hispanic or Latino persons are differentiated from racial groups.

2. Increased Demographic Designations

- Currently the analysis focuses on analyzing rate impacts across income and housing types.
- In the US people of color populations are younger than the White population (based on the U.S. Census Bureau).
- In 2017 the White Population is the only subgroup with people under 40 accounting for less than half of the total population and people over 60 accounting for more than a quarter of the total population.
- Americans who are 80 and older make up 4.8% of the White population but no more than 2.5% of any other subgroup (e.g., Black, Hispanic).

To Increase Demographic Designations

- Utilities should collect data via surveys or census tracts
- This has been done in multiple utilities:
  - Salt River Project in AZ deployed a survey to their customers
  - Peoples Gas in Pittsburgh, PA worked with Peoples Energy analytics to tie census data to their households and then analyzed natural gas usage across the heating season.

3. Enhanced Data-Driven Methods to Assess Rate Impacts and Target At-Risk Customers

Enhanced Demographic Data
(surveys or census)

Energy Bill and Energy Meter Data
(utilities)

Outdoor Temperature Data
(weather stations)

Robust Analytical Tools for Pairing the Various Data Sets (e.g., Peoples Energy Analytics)

Critical Tools for Identifying Hotspots for Energy Affordability Issues

Example of a Data Driven Method for Holistic Analysis of Energy Affordability

nature COMMUNICATIONS

ARTICLE

Check for updates

https://doi.org/10.1038/s41467-022-30146-5 OPEN

Unveiling hidden energy poverty using the energy equity gap

Shuchen Cong [1], Destenie Nock [1,2]✉, Yueming Lucy Qiu [3]✉ & Bo Xing[4]

Income-based energy poverty metrics ignore people's behavior patterns, particularly reducing energy consumption to limit financial stress. We investigate energy-limiting behavior in low-income households using a residential electricity consumption dataset. We first determine the outdoor temperature at which households start using cooling systems, the inflection temperature. Our relative energy poverty metric, the *energy equity gap*, is defined as the

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Inequalities across cooling and heating in households: Energy equity gaps

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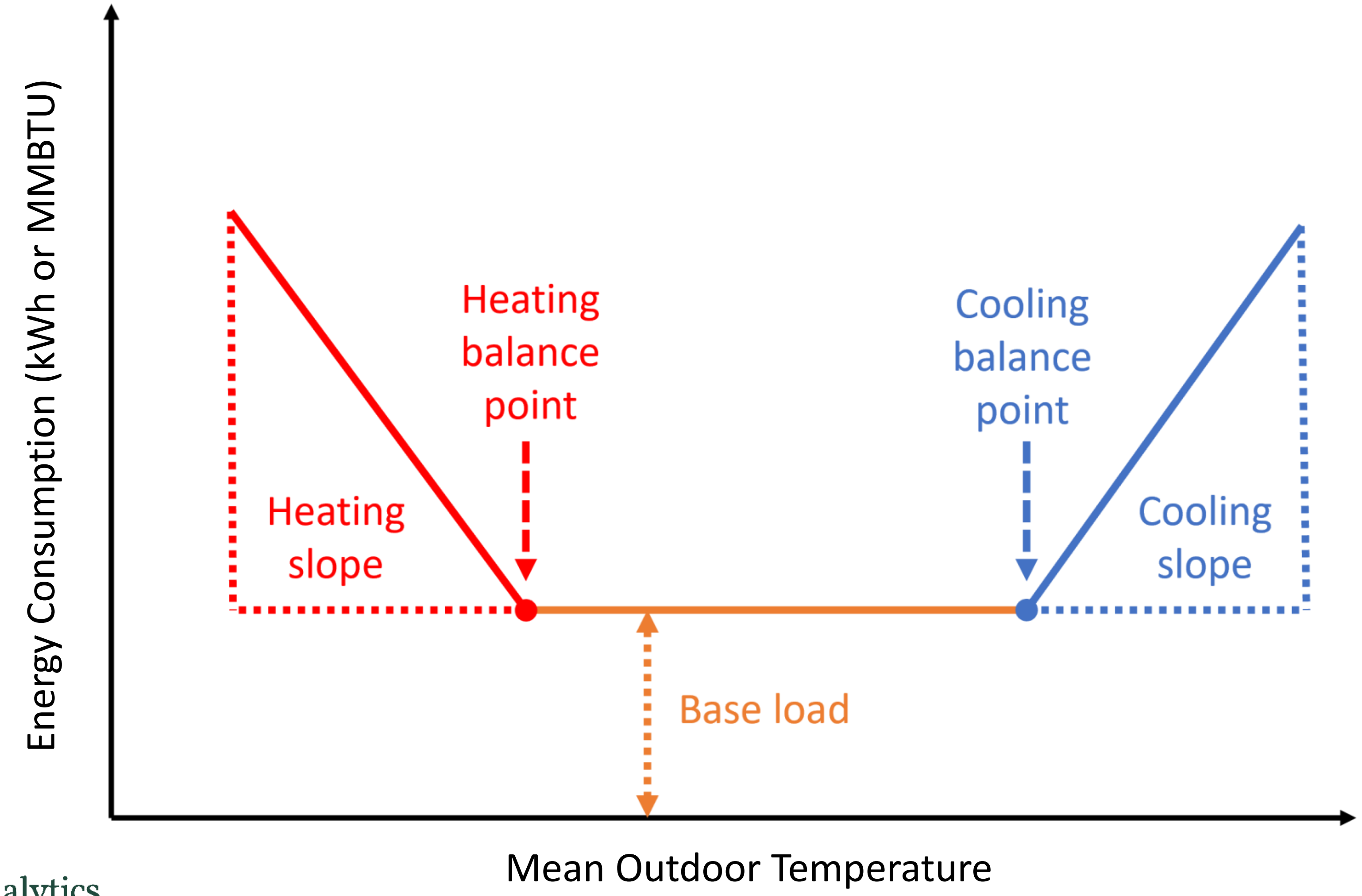
Energy limiting behavior
Energy justice

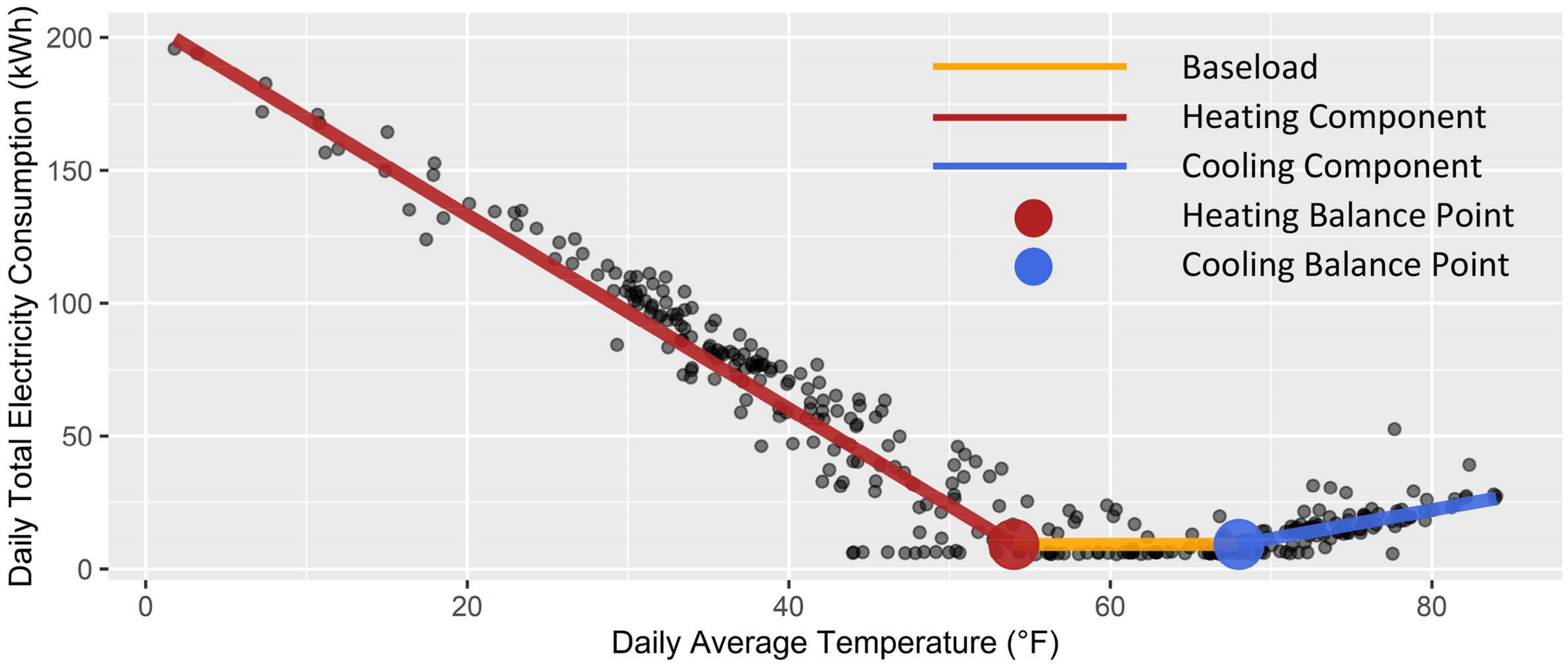
ABSTRACT

Understanding the degree of energy limiting behavior in low-income and vulnerable households is vital to eradicating energy poverty and associated negative health effects. We estimate the outdoor temperatures at which households turn on and off their electricity-based cooling and heating units under a cold climate in northern Illinois, USA ($N = 418{,}255$ for cooling; $N = 22{,}628$ for electric heating). We find that the cooling energy equity gap between low and high income groups is 3 °F (1.7 °C), while the electric-based heating energy equity gap is 6 °F (3.3 °C). The pattern of energy limiting behavior is found to be different between the cooling season and the heating season. Our metrics contribute to the policy design of home energy bill and weatherization assistance programs to identify vulnerable households in a cold climate: Among low-to-middle-income house-

Meter Data at household level can be used to understand energy consumption behavior for individual households and heating and cooling use (or lack thereof).

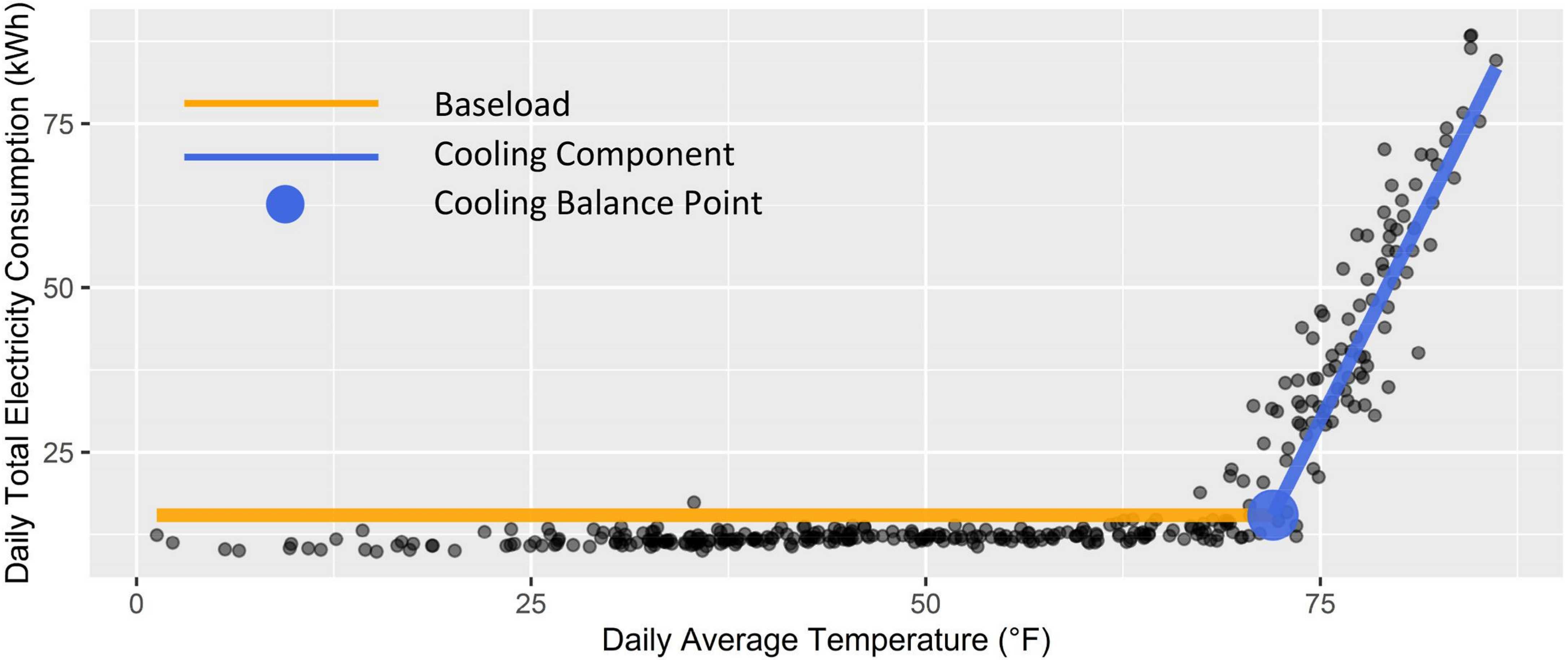


Household with electric heating but no central AC (most likely a window unit)

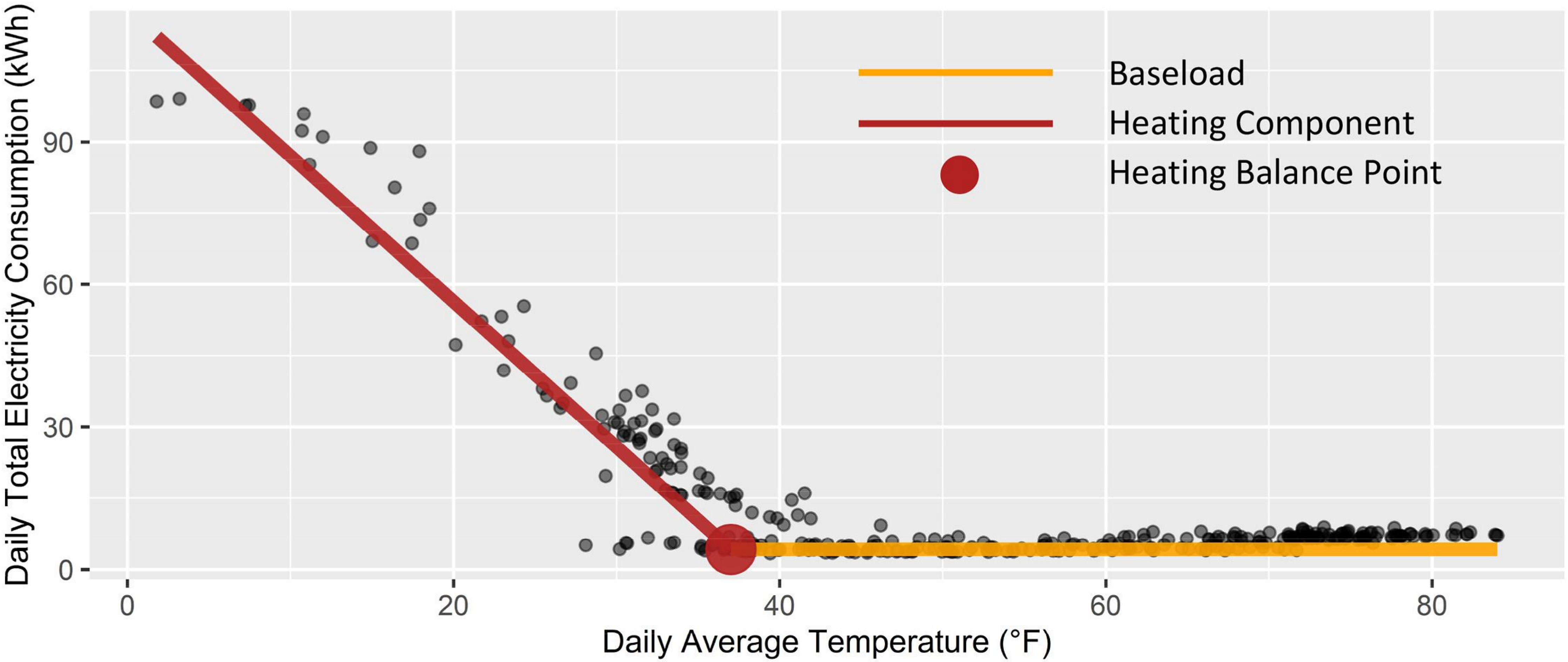


Peoples Energy Analytics

Household without electric heating (no heat pump)

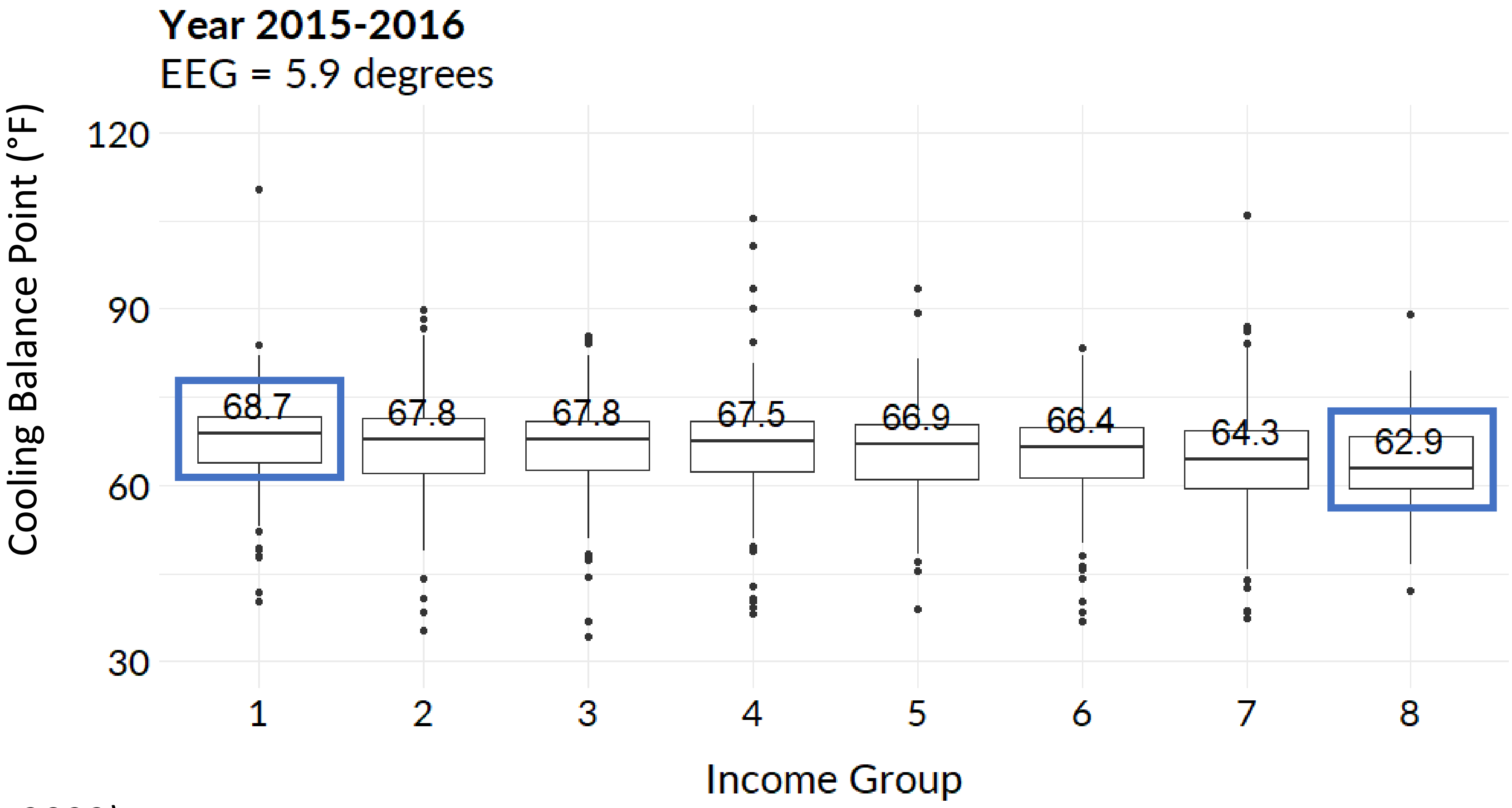


Household at risk of heat stroke (no AC)



Arizona: the energy equity gap (EEG) for cooling

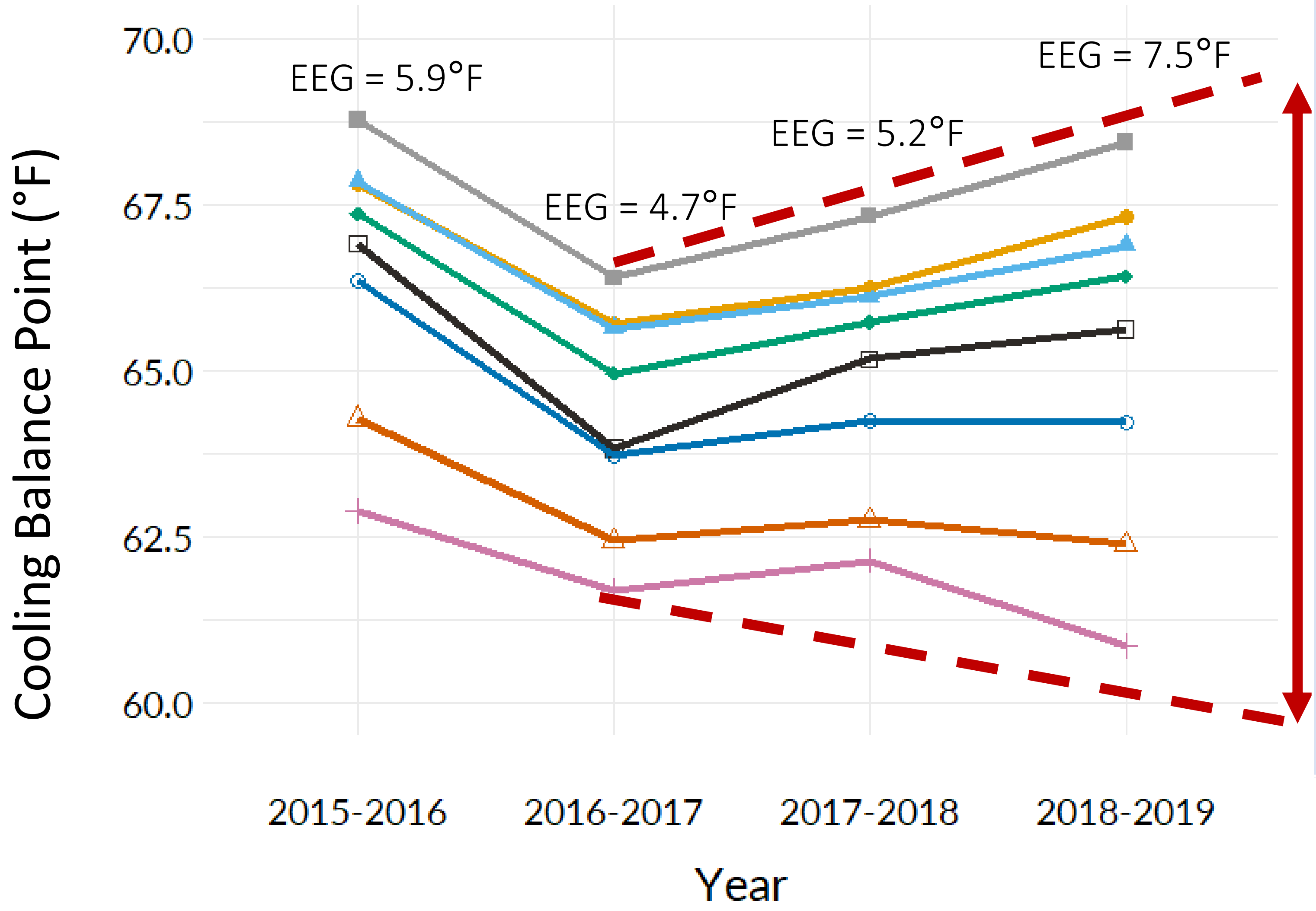
$$EEG = \max(\inf\_temp_{median}) - \min(\inf\_temp_{median})$$



Income Group
1. Less than $15,000
2. $15,000 to $24,999
3. $25,000 to $34,999
4. $35,000 to $49,999
5. $50,000 to $74,999
6. $75,000 to $99,999
7. $100,000 to $149,999
8. $150,000 or more

(Cong et al. 2022)

The energy equity gap in AZ widened (EEG) (2015-2019)



Gap widening over time.

Correlated with increasing electricity costs

How will decarbonization effect this (retirement of high-cost fossil fuel plants, but build out of transmission)

21

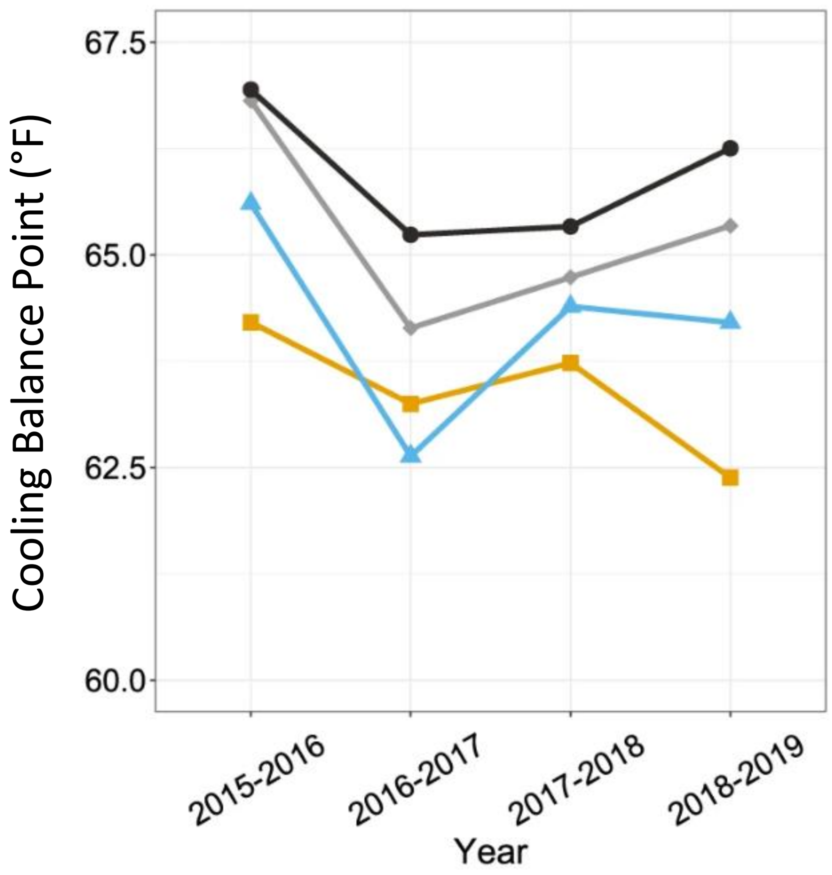
(Cong et al. 2022)

How do people’s demographics impact their comfort and our affordability indicators?

Disaggregated Age and Race Analysis

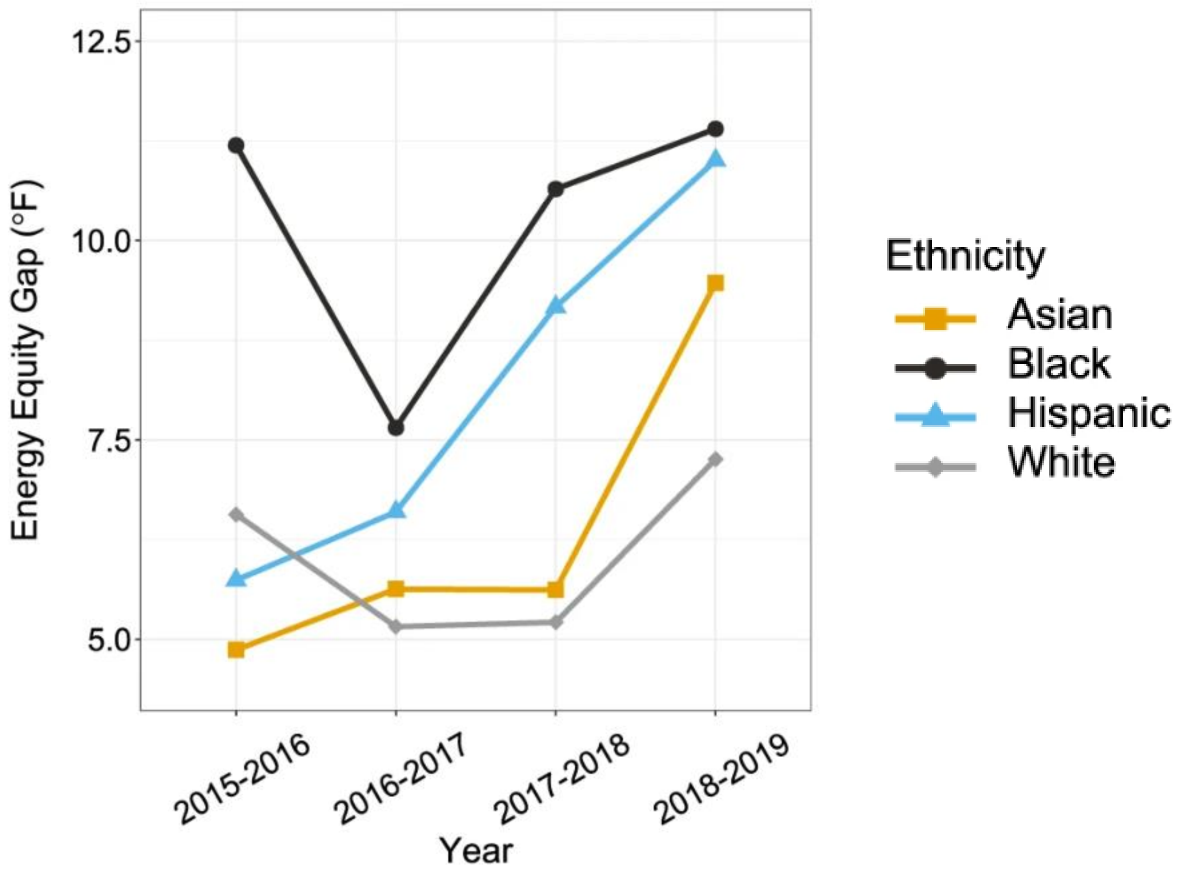
EEG vs. Ethnicity

Median inflection temperature for each ethnicity



Left

EEG by ethnicity

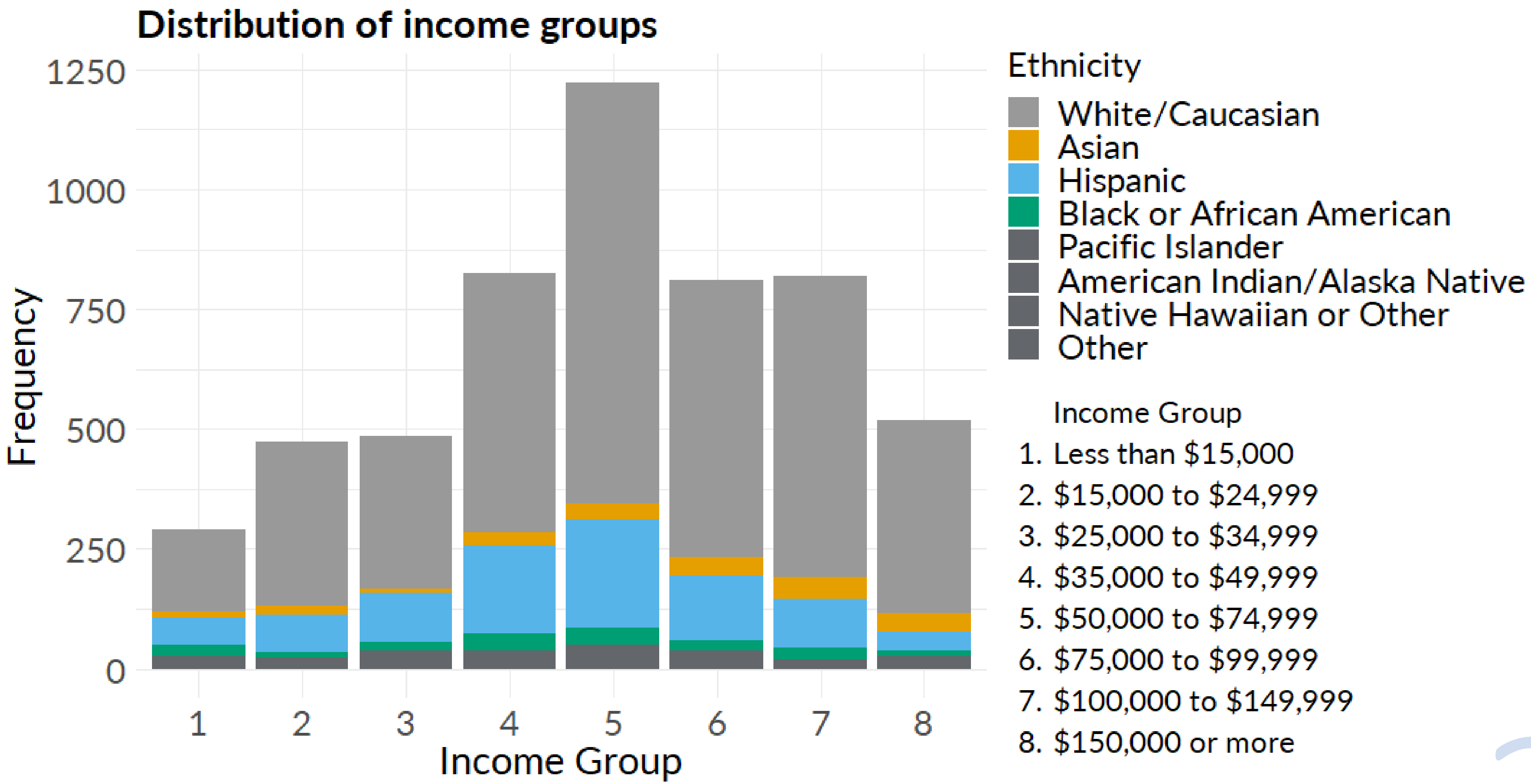


Right

(Cong et al. 2022)

N = 6,000 Residential Electricity Customers

Demographics: Investigating racial inequality in energy use



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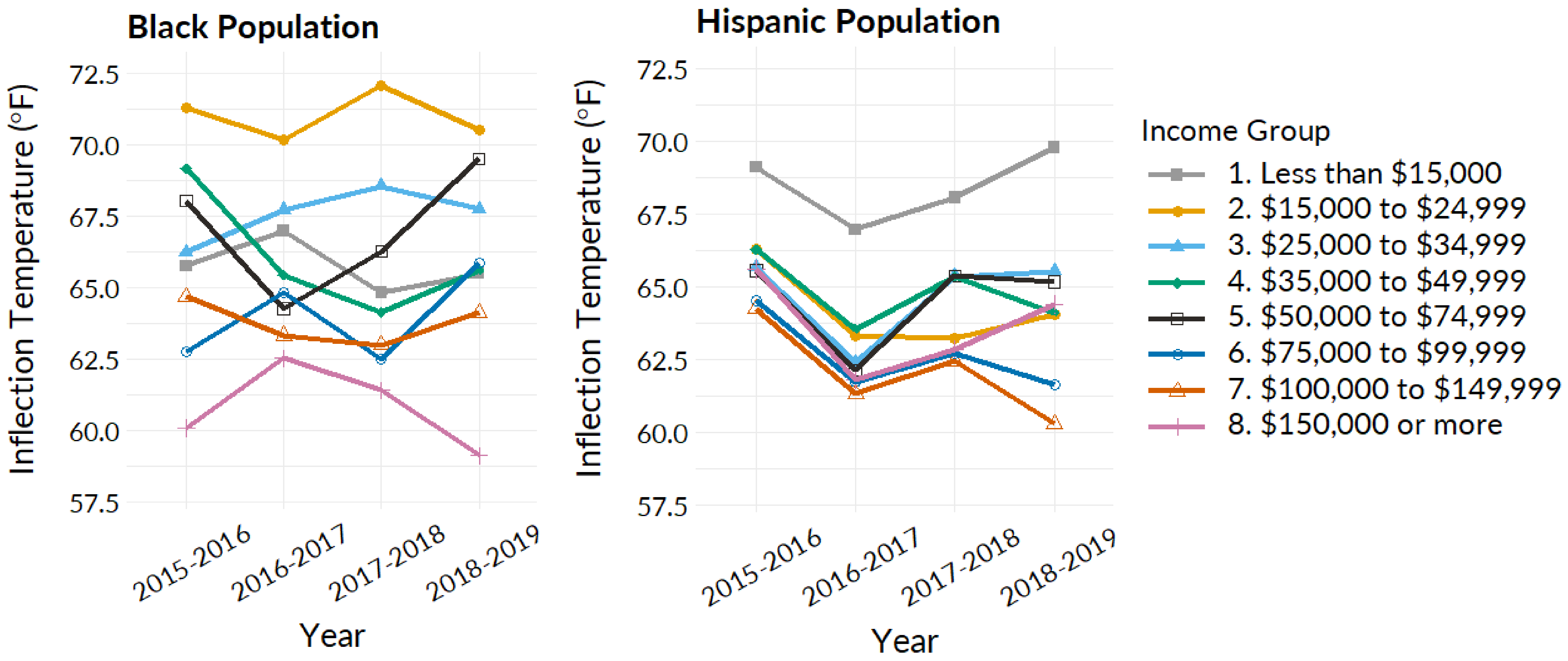
Energy equity gap: preferences vs inequality

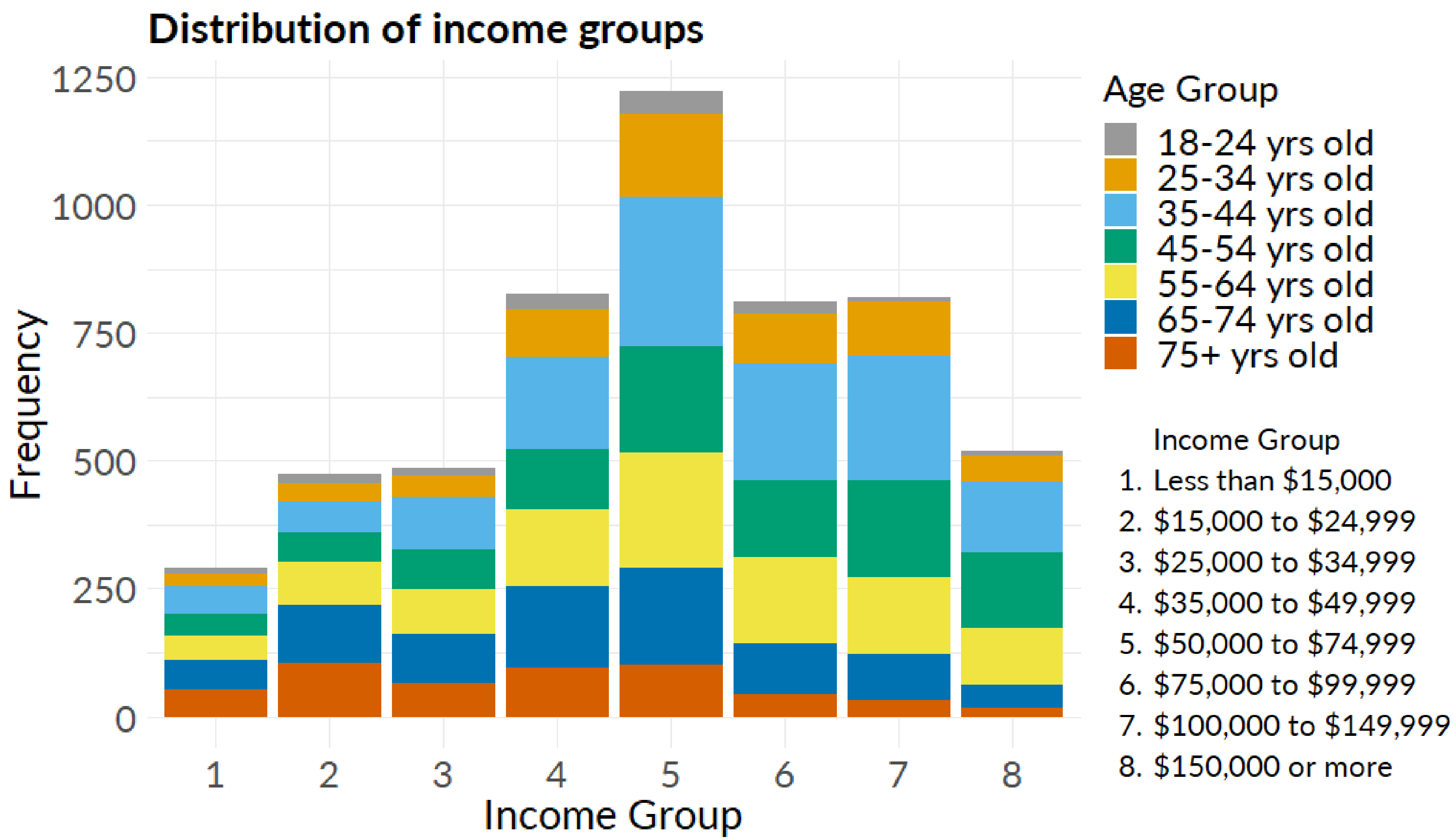


(Cong et al. 2022)

Second lowest group in Black population need more information about subsidies.

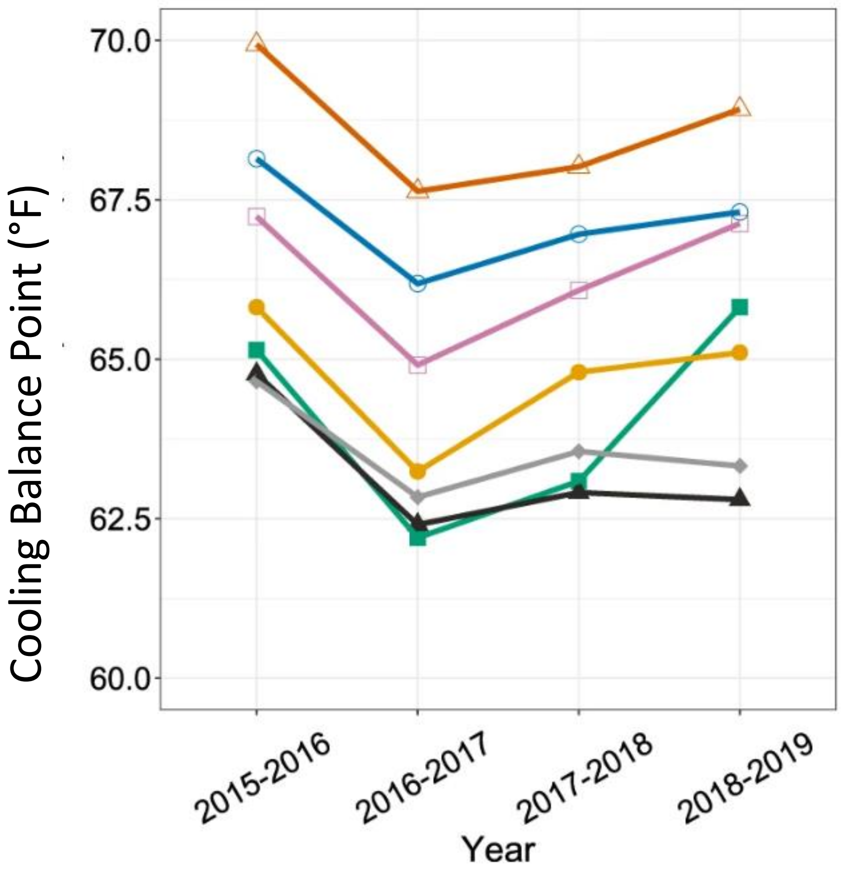
Identifying How Age Impacts Energy Affordability

Demographics: Investigating age inequality in energy use



EEG vs. Age

Median inflection temperature for each age



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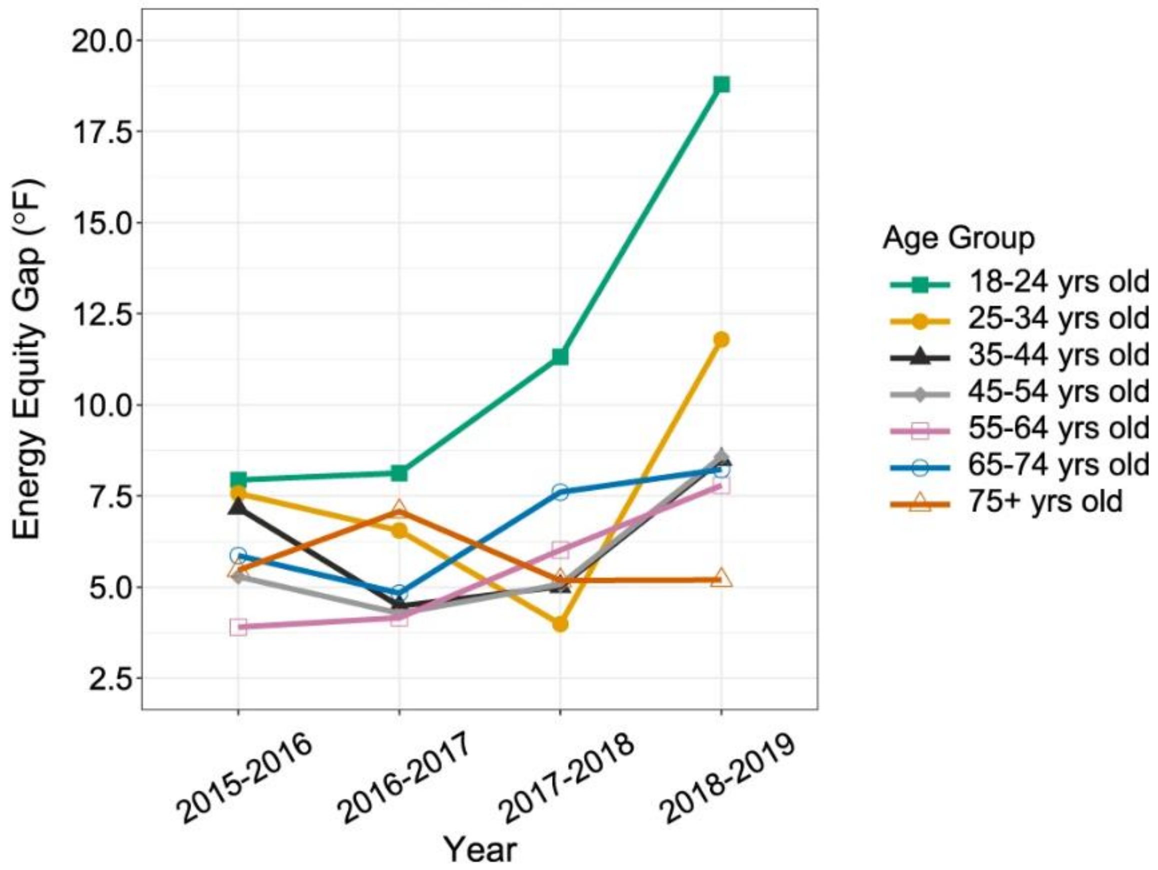
EEG by Age

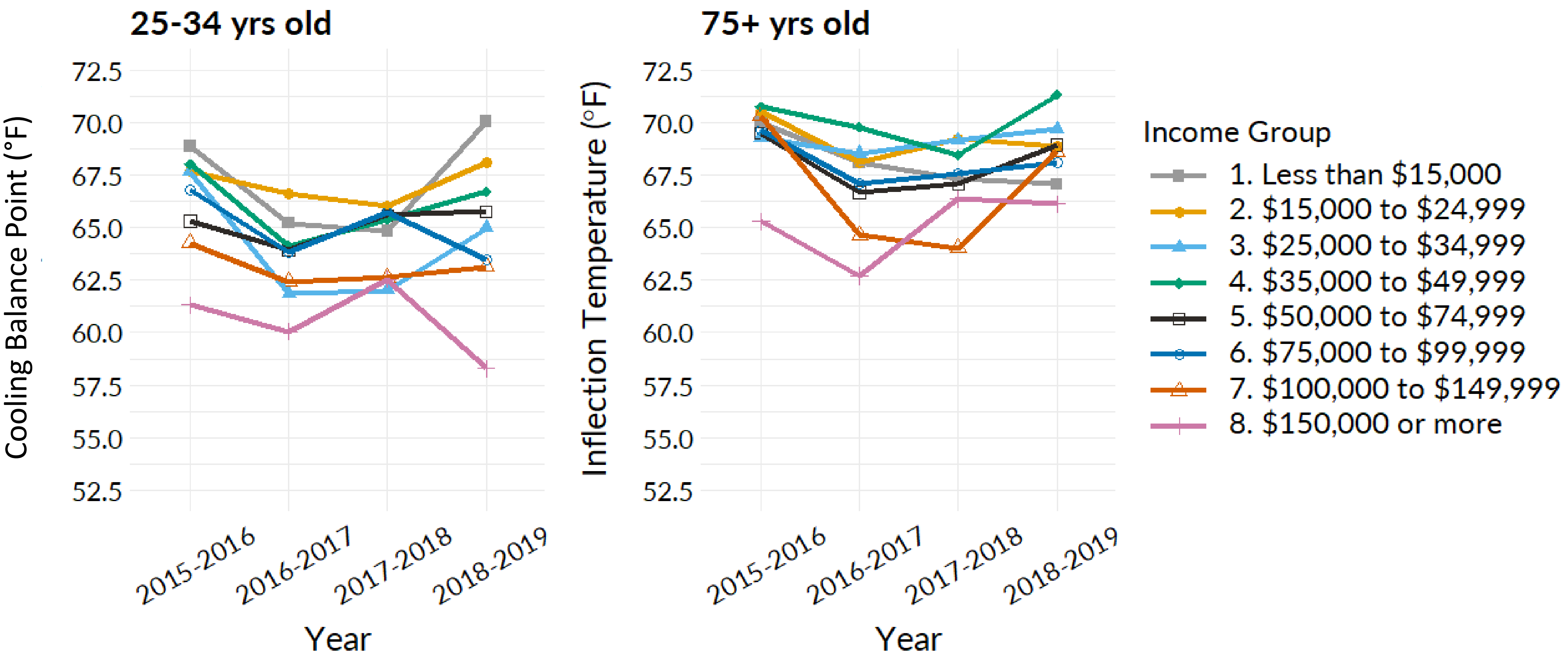


Right

(Cong et al. 2022)

N = 6,000 Residential Electricity Customers

Energy equity gap: preferences vs inequality



(Cong et al. 2022)

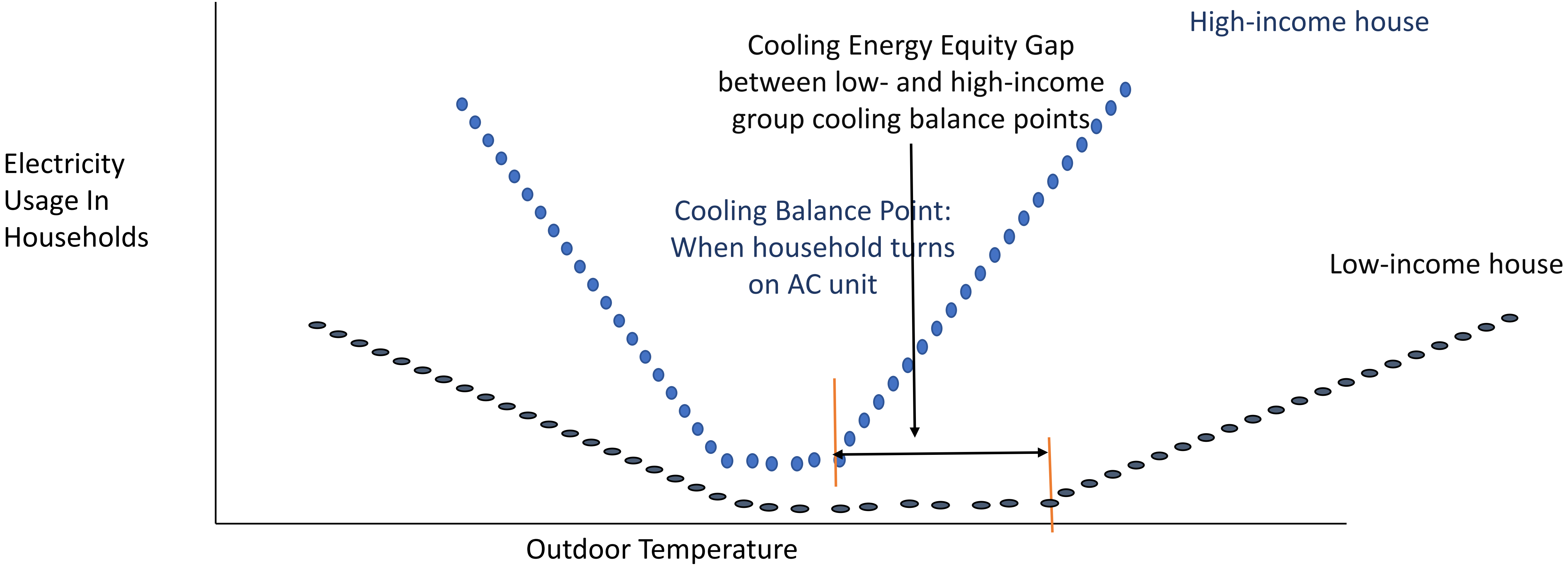
Investigating how rate changes impact energy usage

Arizona Metric	*Change from year to year*		
	Year 1 to 2	Year 2 to 3	Year 3 to 4
Max Average Monthly Max Temperature	1.0%	-0.2%	-0.2%
Cooling Degree Days (CDD)	3.6%	2.5%	-5.2%
Average residential electricity retail price (cents/kWh)	2.4%	2.7%	-2.7%
Energy Equity Gap	-20.3%	10.6%	44.2%

Behavior changes may take a while to catch up to price and temperature shifts

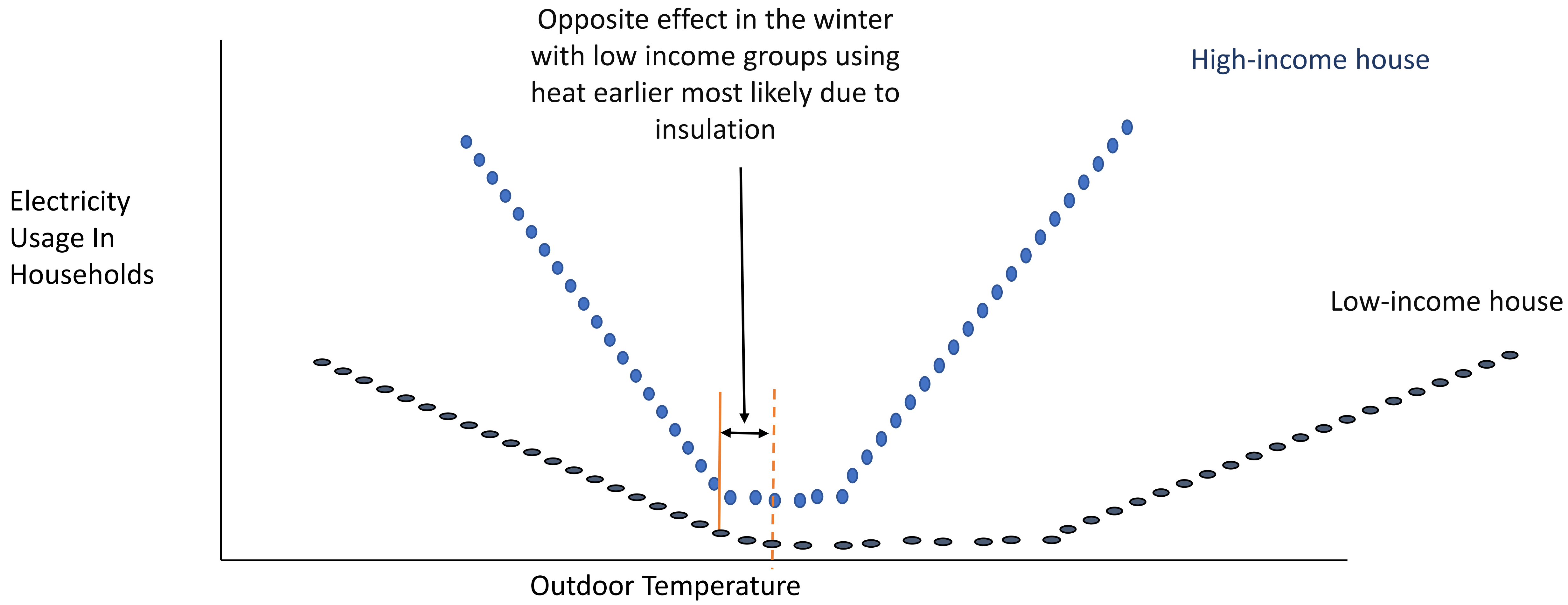
High Level Takeaways from Data Analysis

Energy Equity Gap



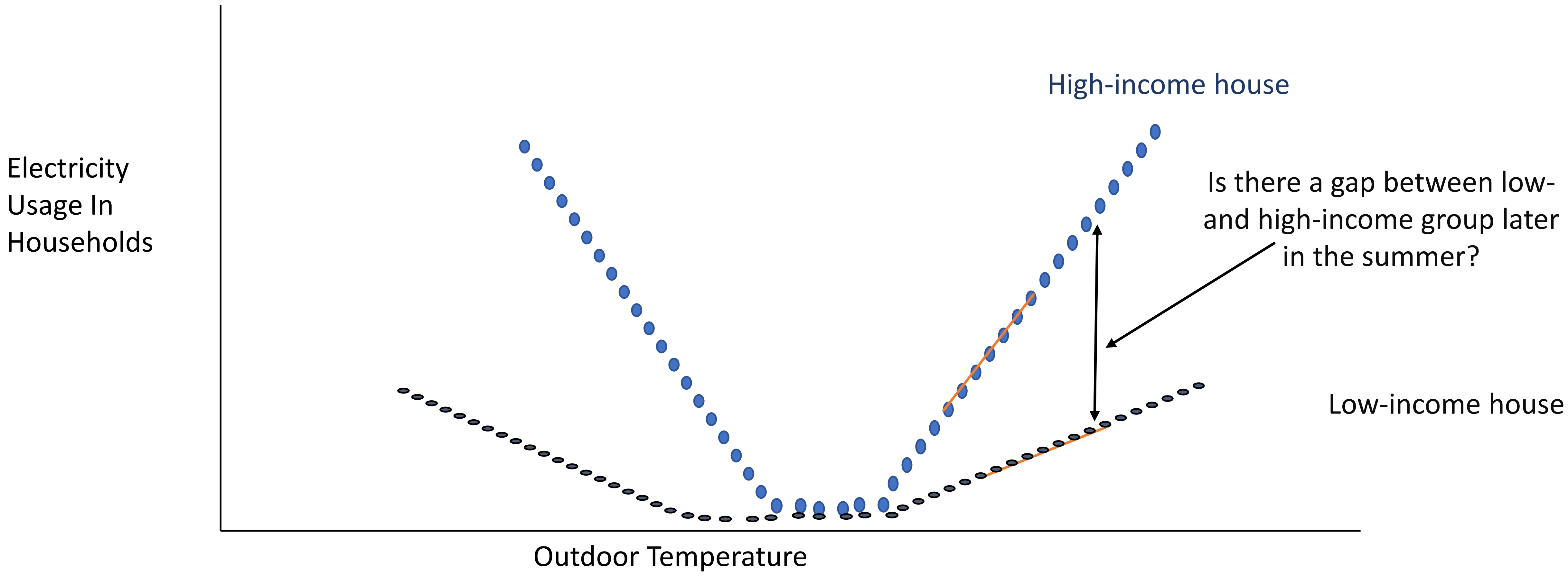
(Cong et al 2022 in Nature Communications and Huang et al (2023))

Energy Equity Gap



(Cong et al 2022 in Nature Communications and Huang et at (2023))

Slope Gap

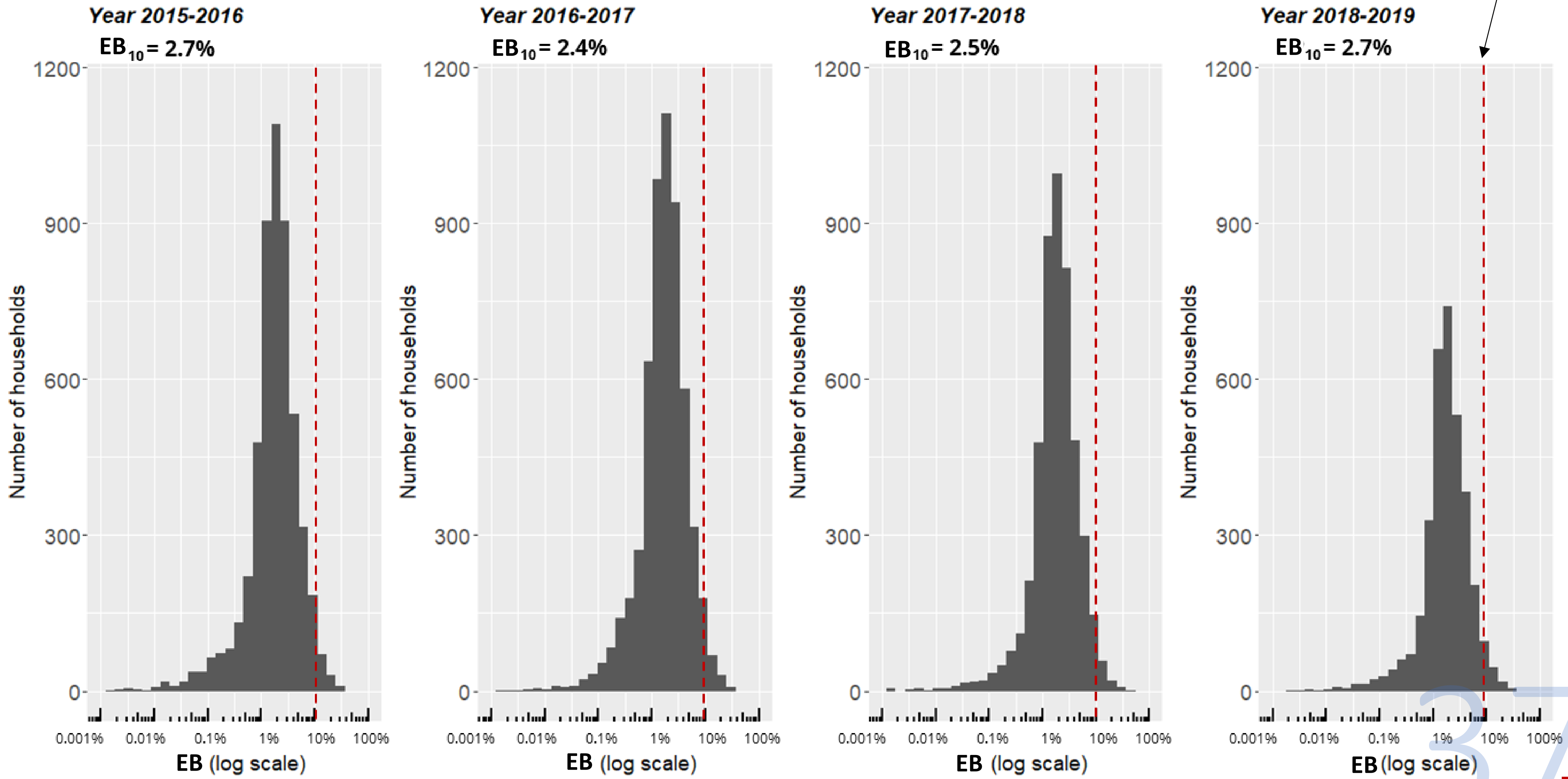


(Kwon et al 2023)

Comparing with Economic Based Poverty Metric

How does the energy burden (EB) measure compare?

EB = 10% threshold

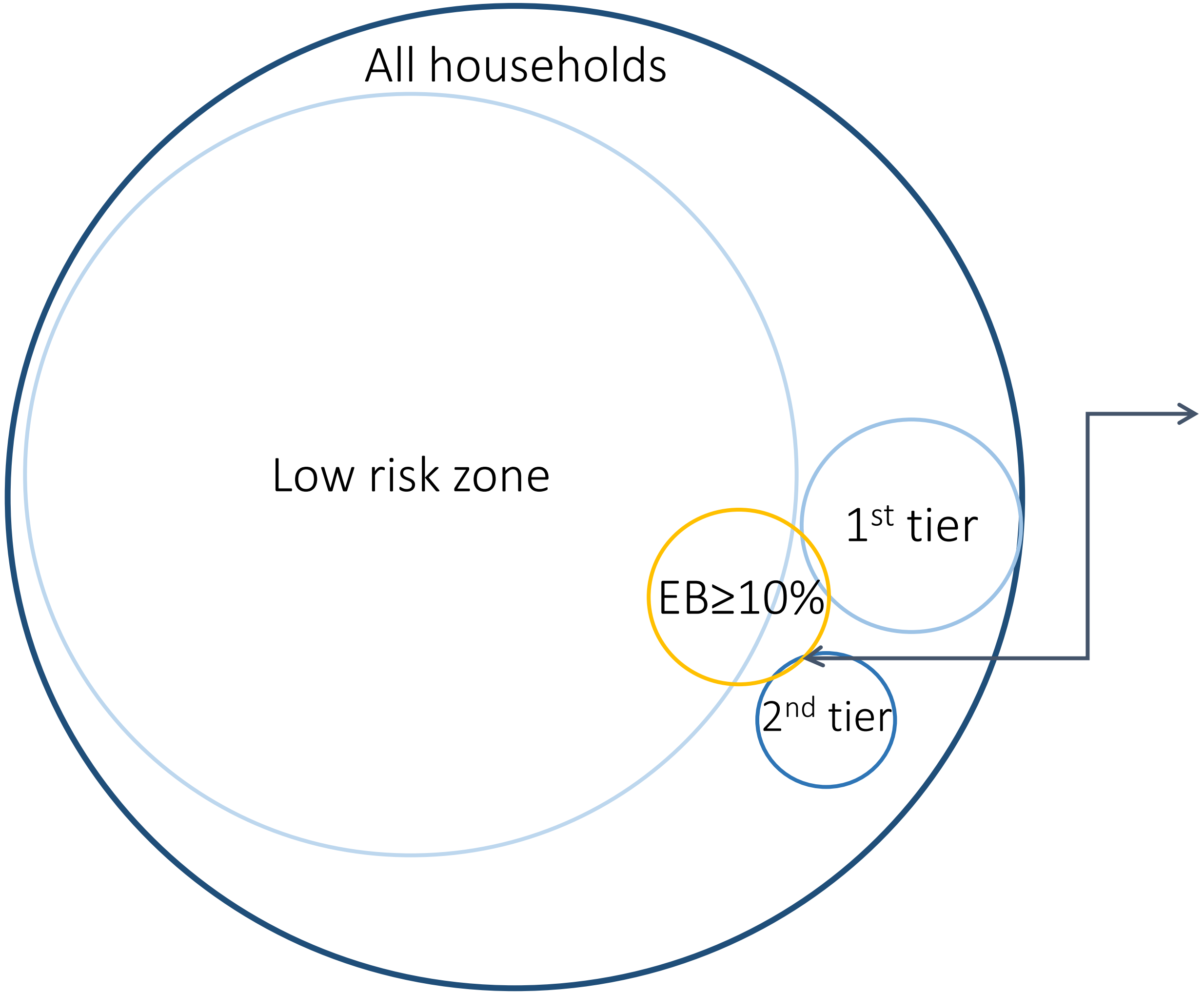


How many do you believe overlapped?

Energy Equity Gap 2nd tier - 86 poor

Energy Burden 10% - 141 energy poor

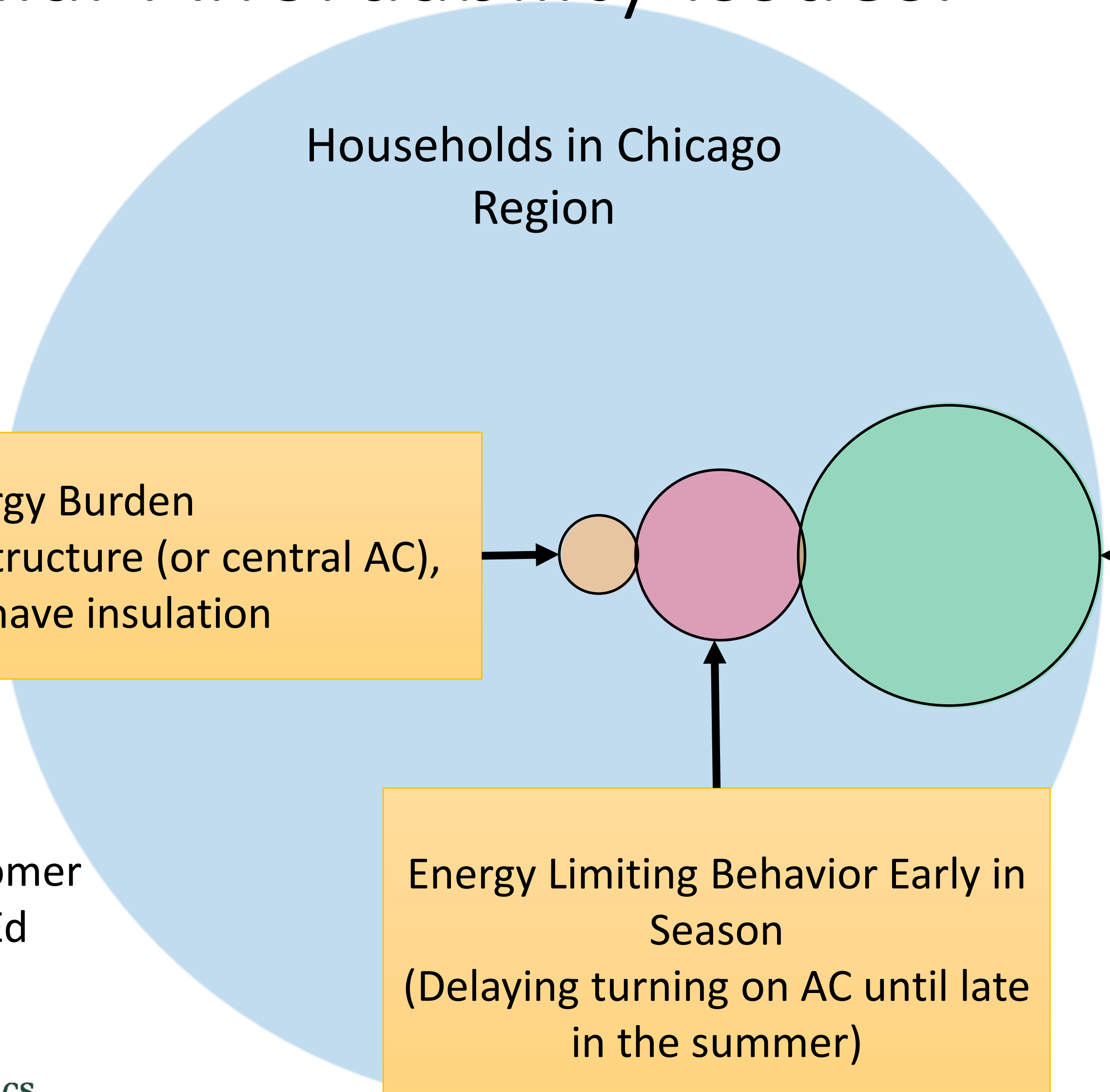
Energy equity gap (EEG) vs. Energy burden (EB): Who has been left out?



Only 3 out of 4577 households are both in the energy poverty zone (2nd tier) and has EB ≥10%

Representation of the number of households captured by EEG vs EB, 2015-2016

When My Team Replicated the Analysis In Chicago We Found Similar Affordability Issues.



Households in Chicago Region

High Energy Burden
Working energy infrastructure (or central AC), but may not have insulation

Energy Limiting Behavior Throughout the Season (Broken or No AC)

Energy Limiting Behavior Early in Season
(Delaying turning on AC until late in the summer)

Total

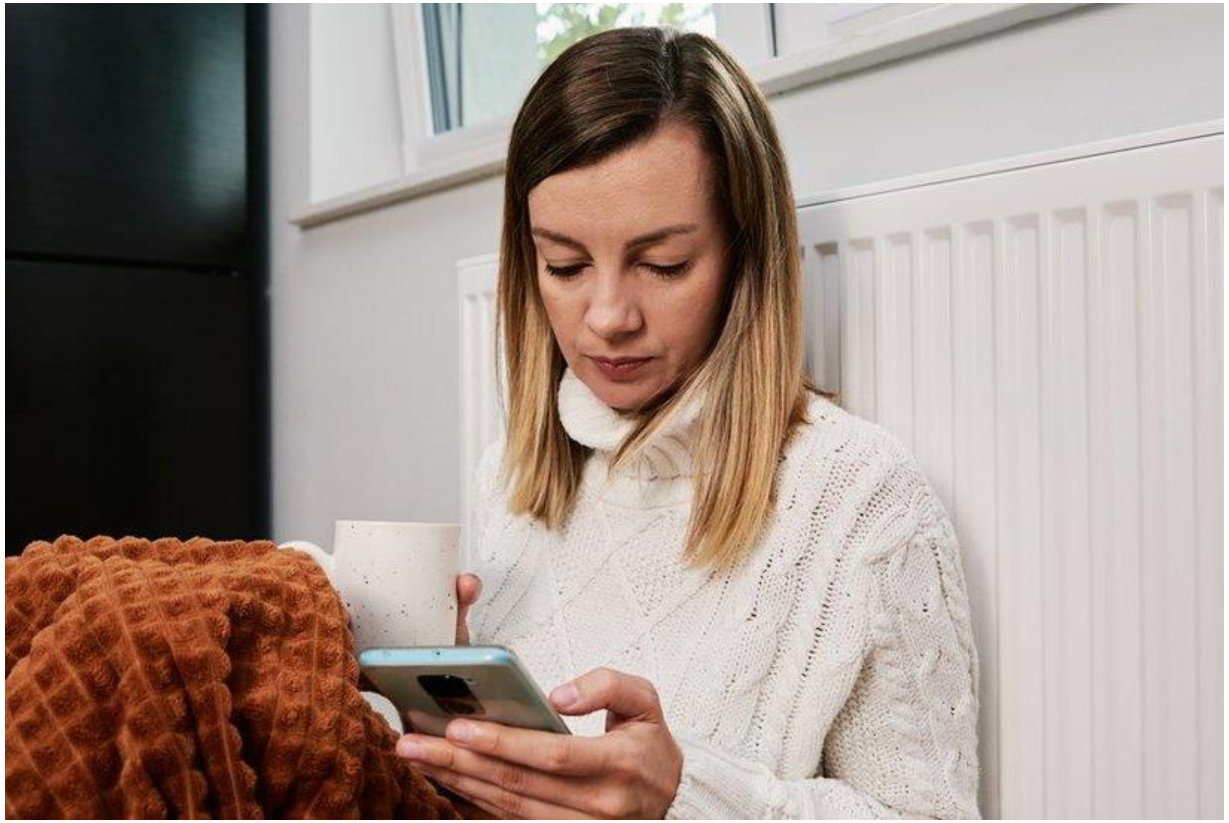
Energy burden ≥ 6%

Cooling slope < 0.1 kWh/ °F

Cooling balance point > 78°F

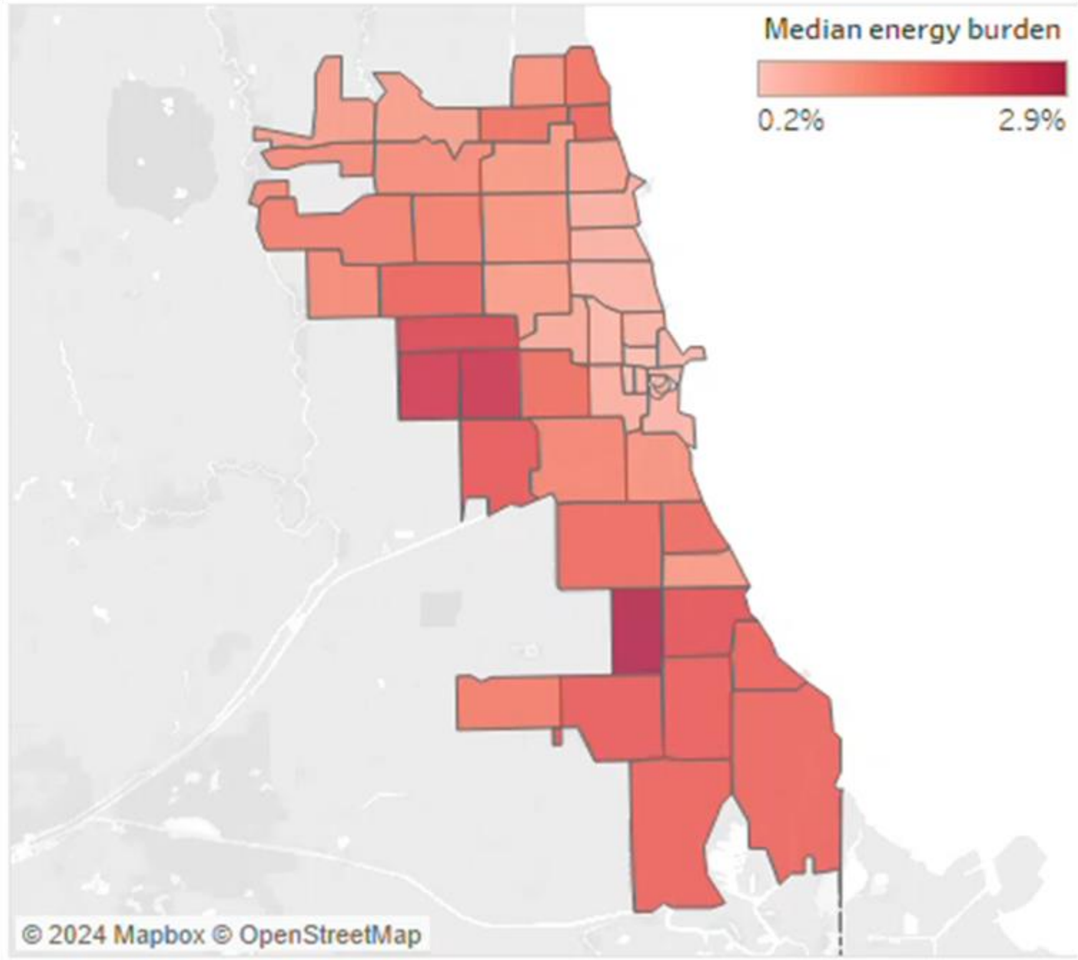
Circles Represent Customer Proportions in ComEd Region

There needs to Be A Holistic Approach and Better Targeting (Recommendation 4 and 5)



Customer classification dashboard

Zip Codes – High Financial Risk



Accounts – High Financial Risk

Accounts	
1001907	16.9%
1001859	16.5%
1001897	14.6%
1001853	14.2%
1001906	14.2%
1001842	14.0%
1001893	13.7%
1001836	13.7%
1001843	13.6%
1001822	13.4%
1001866	13.3%
1001838	12.9%
1001824	12.4%
1001889	12.4%
1001817	12.4%
1001905	12.2%
1001857	12.1%

Hidden for Privacy

*Dashboards are created for six risk categories

Meter data analysis can benefit LMI customers through

- Identifying multiple at-risk households at the individual level
- Facilitating individual targeting of households for energy upgrades, bill assistance, and energy efficiency deployment
- Identifying households who are at risk of heat stroke (due to lack of AC use) or cold illness (due to lack of heating use)
- Finding households who need help early on
- Examples of Utilities doing this:
    - Peoples Gas – Pittsburgh, PA
    - Southern Company – AL, MS, GA

AMI Data Enhances the Targeting

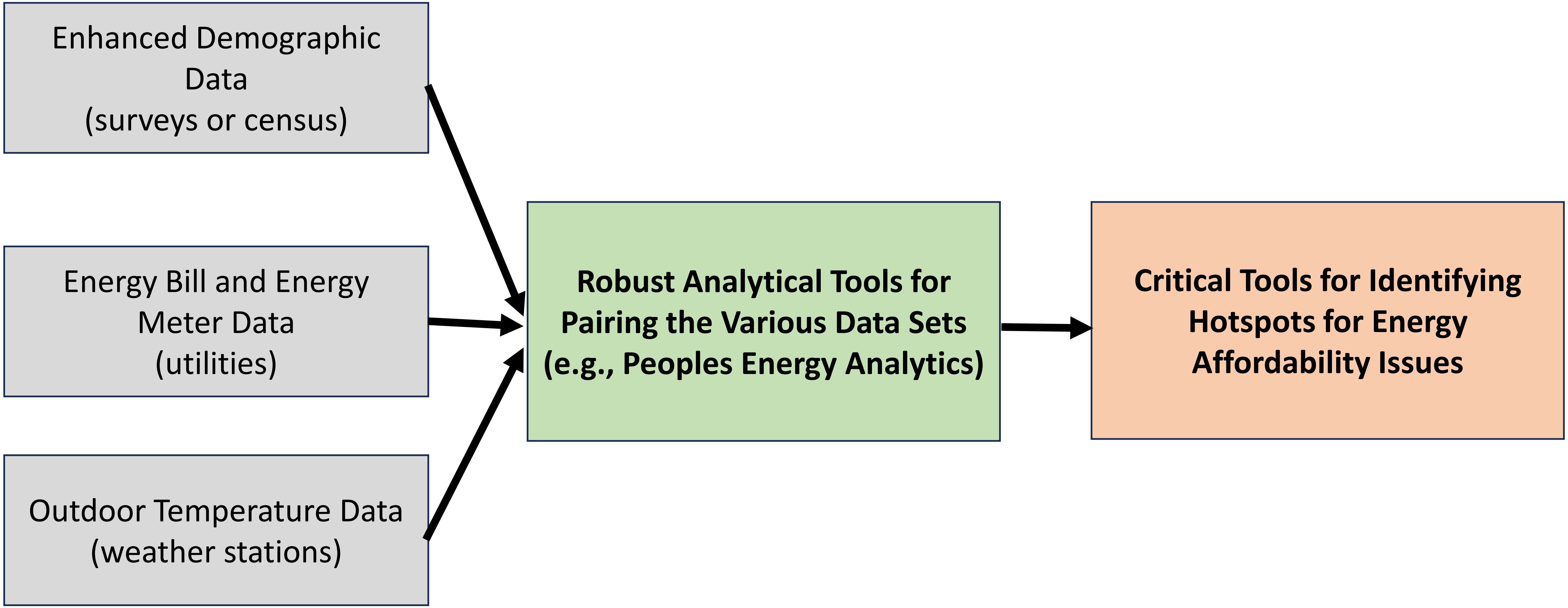
6. Continue Support for Upfront Costs of Fuel Switching

- While the Near-Term Rate Strategy addressed the operational costs of electrification in great detail, there is an opportunity to add how upfront costs will continue to be a large factor in accelerating or impeding electrification in low-to-moderate income households.
- In MA there are generous incentives for subsidizing heat pumps - 100% for low-income households.
  - Utilities should use targeting marketing to make sure people are aware of these programs.
- Supporting upfront costs is important for managing the renter vs. owner dynamic
  - Bill savings won't sway a building owner's decision to adopt a heat pump, so upfront cost incentives are important for electrifying renter-based households.

Recap of Recommendations

1. **Inclusion of a Clear Definition of Energy Affordability**
2. **Increased Demographic Designations**
3. **Enhanced Data-Driven Methods to Assess Rate Impacts and Target At-Risk Customers**
   - **Protections for Low- and Moderate-Income Households**
4. **Holistic View of Housing-Related Energy Burdens**
5. **Integrated Approach for Supporting At-Risk Customers**
6. **Support for Upfront Costs of Fuel Switching**

Need to Identify Hot Spots for Energy Affordability Issues



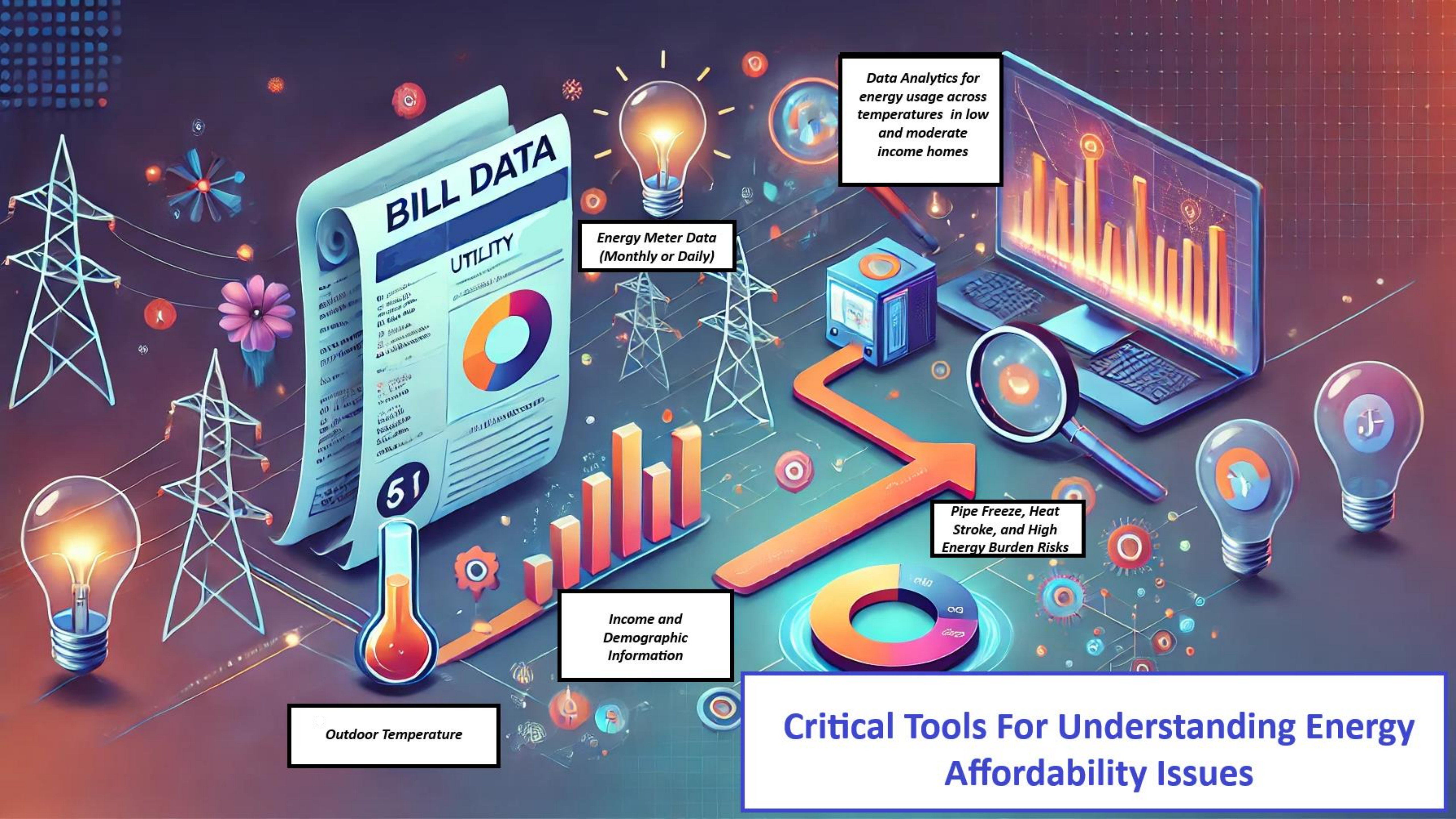
Conclusions

- Critical tools for understanding hot spots for energy affordability issues include:
  - Energy bill and meter data at monthly or daily level (energy utilities)
  - Additional demographic data (state, census, or utilities)
  - Good analytical methods to pair bill and demographic data (internal data teams or consultants)

- Examples of this in practice include companies collaborating with Peoples Energy analytics (Peoples Gas (Pittsburgh, PA) and Southern Company (AL, GA, MS)).

Conclusions

- The recommendations provided here aim to strengthen Near-Term Rates Strategy by making it more equitable, data-informed, and focused on long-term affordability.
- Multiple utilities are implementing the data-centric approach to identifying and addressing energy affordability issues (e.g., Peoples Gas (monthly meter data) who is collaborating with Peoples Energy Analytics).
- By adopting these recommendations, the plan can help make the transition to electrification more accessible and sustainable for all households, particularly those most vulnerable to rising energy costs and energy-related hardships.


BILL DATA
UTILITY
51
Energy Meter Data (Monthly or Daily)
Data Analytics for energy usage across temperatures in low and moderate income homes
Pipe Freeze, Heat Stroke, and High Energy Burden Risks
Income and Demographic Information
Outdoor Temperature
Critical Tools For Understanding Energy Affordability Issues

Contact and Acknowledgements

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  - BlueSky: @Destenie

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- Huang, L., Nock, D., Cong, S., & Qiu, Y. L. (2023). Inequalities across cooling and heating in households: Energy equity gaps. Energy Policy, 182, 113748.
- Kwon, M., Cong, S., Nock, D., Huang, L., Qiu, Y. L., & Xing, B. (2023). Forgone summertime comfort as a function of avoided electricity use. Energy Policy, 183, 113813.
- Cong, S., Nock, D., Qiu, Y. L., & Xing, B. (2022). Unveiling hidden energy poverty using the energy equity gap. Nature communications, 13(1), 2456.
- Cong, S., Ku, A. L., Nock, D., Ng, C., & Qiu, Y. L. (2024). Comfort or cash? Lessons from the COVID-19 pandemic's impact on energy insecurity and energy limiting behavior in households. Energy Research & Social Science, 113, 103528.