Reducing Barriers to Residential Energy Security

Johanna Mathieu[1], Carina Gronlund[2], Marie O'Neill[3], Shelie Miller[4], Tony Reames[4],
Zachary Rowe[5], MaryCruz Gutierrez[6], Raquel Garcia[6], Gibran Washington[7], Katrina Rinehart[8],
Madeline Miller[4], Jo Brooks[1], Xavier Farrell[1], Giuliana Cusumano[2], Kaan Cem Ketenci[3], Anchal Malh[3], Korrey Monroe[3]

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Community Need

The goal of this project is to reduce energy insecurity, improve residents' comfort, and measure health outcomes in low-to-moderate income (LMI) households in three neighborhoods in Detroit, Michigan, which is one of the top ten highest energy burdened metros in the US, where LMI households spend 15 - 30% of their income on energy costs (6% or less is considered affordable).
The three neighborhoods are:
- **Jefferson Chalmers:** A predominantly Black homeowner community on Detroit's east side.
- **Southwest Detroit:** A predominantly Latinx homeowner community.
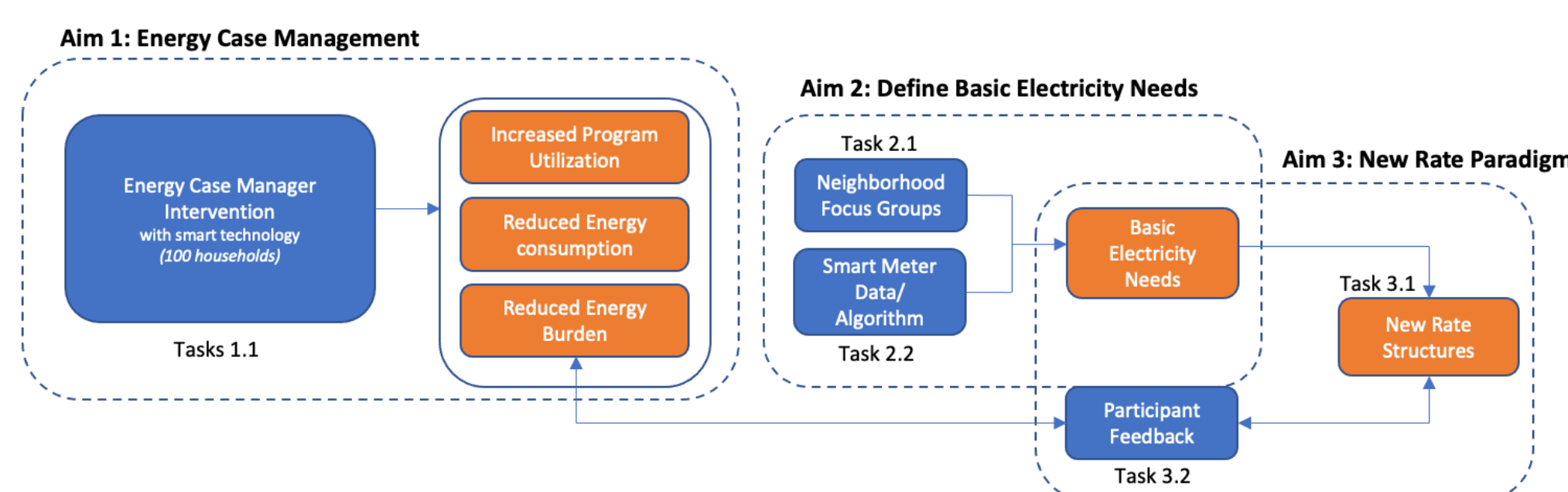- **The Villages at Parkside:** A predominantly Black multi-family renter community.

Figure 1: A summary of our research approach. The blue boxes represent research inputs, and the orange boxes represent research outputs.

Work to date

- Designed an Energy Case Manager (ECM) intervention and held a series of workshops to train community partners to be ECMs that can assess household energy and appliance profiles to form data informed recommendations.
- Collaborated with ECMs to generate digestible summaries and overviews, an Energy Improvement Plans (EIP), of each home's energy usage and expenditures to streamline the analysis stage.
- The EIPs are being delivered by follow up calls from the ECMs to participants and they are 55% complete. The calls consist of ECMs giving participants information about assistance programs they qualify for, information about appliance replacement programs and information about the various rate options that are available to the participants. Rate plan comparisons use data from participants smart meters to determine what is the most economical option for them.
- Temperature monitors for residents at the the Village's and energy efficiency literature have been distributed. Some residents have received energy efficient installs including low-flow shower heads, pipe wrapping, LED light bulbs, faucet aerators, Wi-Fi enabled thermostats, and Energy Star refrigerators.
- Creation of PLUTO (participant lookup tool) that processes demographic, socioeconomic, major appliance ownership/usage, and smart meter data to help make recommendations for relevant assistance, energy efficiency, weatherization, and electricity rate programs.
- 40 electricity submeters have been installed throughout Southwest Detroit and in Jefferson Chalmers through a partnership with Pecan Street.
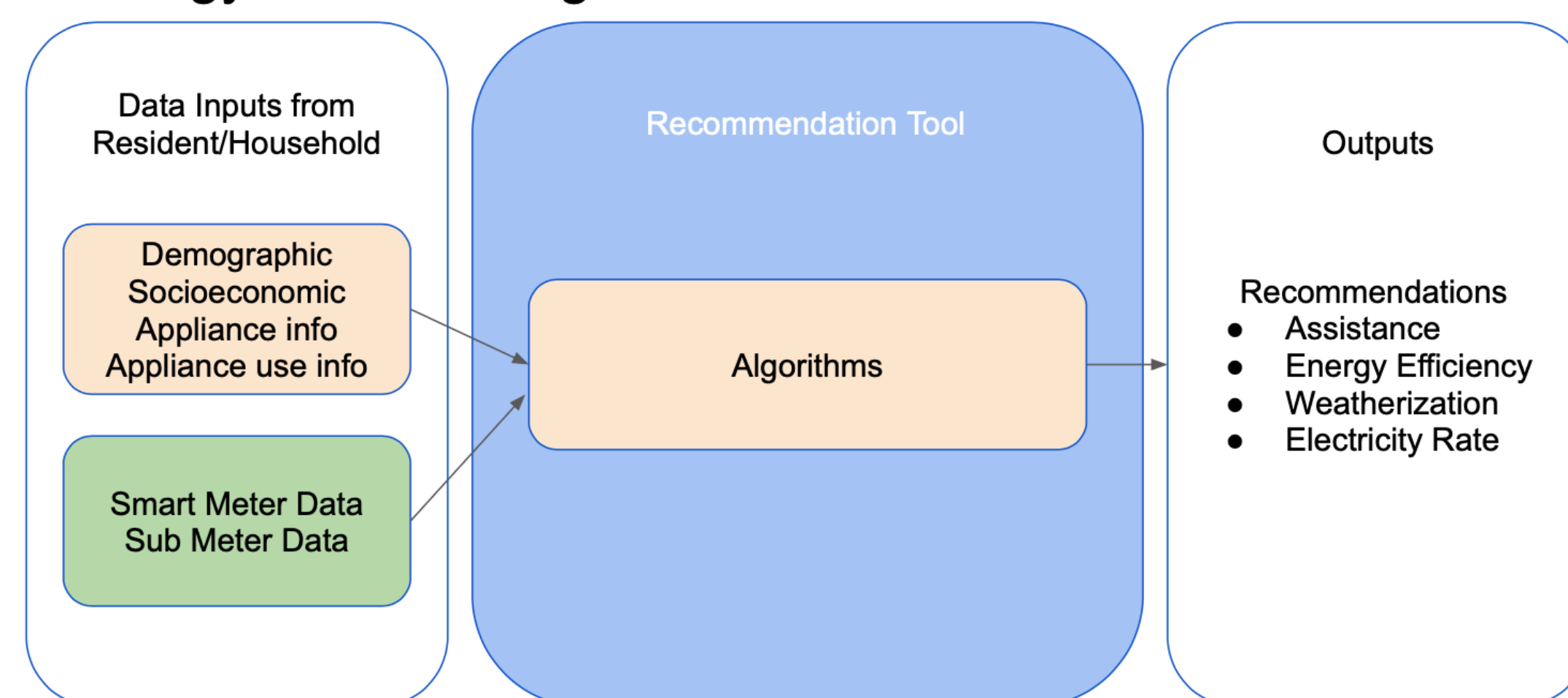
Energy Case Manager Tool

Figure 2: The case management intervention tool provides the ECM with recommendations unique to the home based on data about participants and their appliances, as well as their smart meter and, if present, submetering data.

Intellectual Merit

- **Geographical/Demographic Targeting**: Developing a neighborhood-embedded energy case management intervention that acknowledges community/cultural differences across energy insecure areas.
- **Uniqueness of Recommendation**: ECMs create unique energy improvement plans (EIPs) for participants based on their smart meter data and house/household characteristics that are aimed at reducing energy burden and improving energy efficiency and/or home comfort.
- **Combinational**: Develop social-technological methods to help quantify household-specific energy needs and use this information in conjunction with community.
- **Energy Justice:** The goal of Aim 3 is to develop a new electricity rate paradigm that seeks to achieve the following objectives: i) a free level of basic electricity, ii) supplemental electricity priced to cover utility provider costs, iii) dynamic stability, and iv) rates that encourage energy efficiency and renewable energy investments.

Figure 1.a - A Summer Day
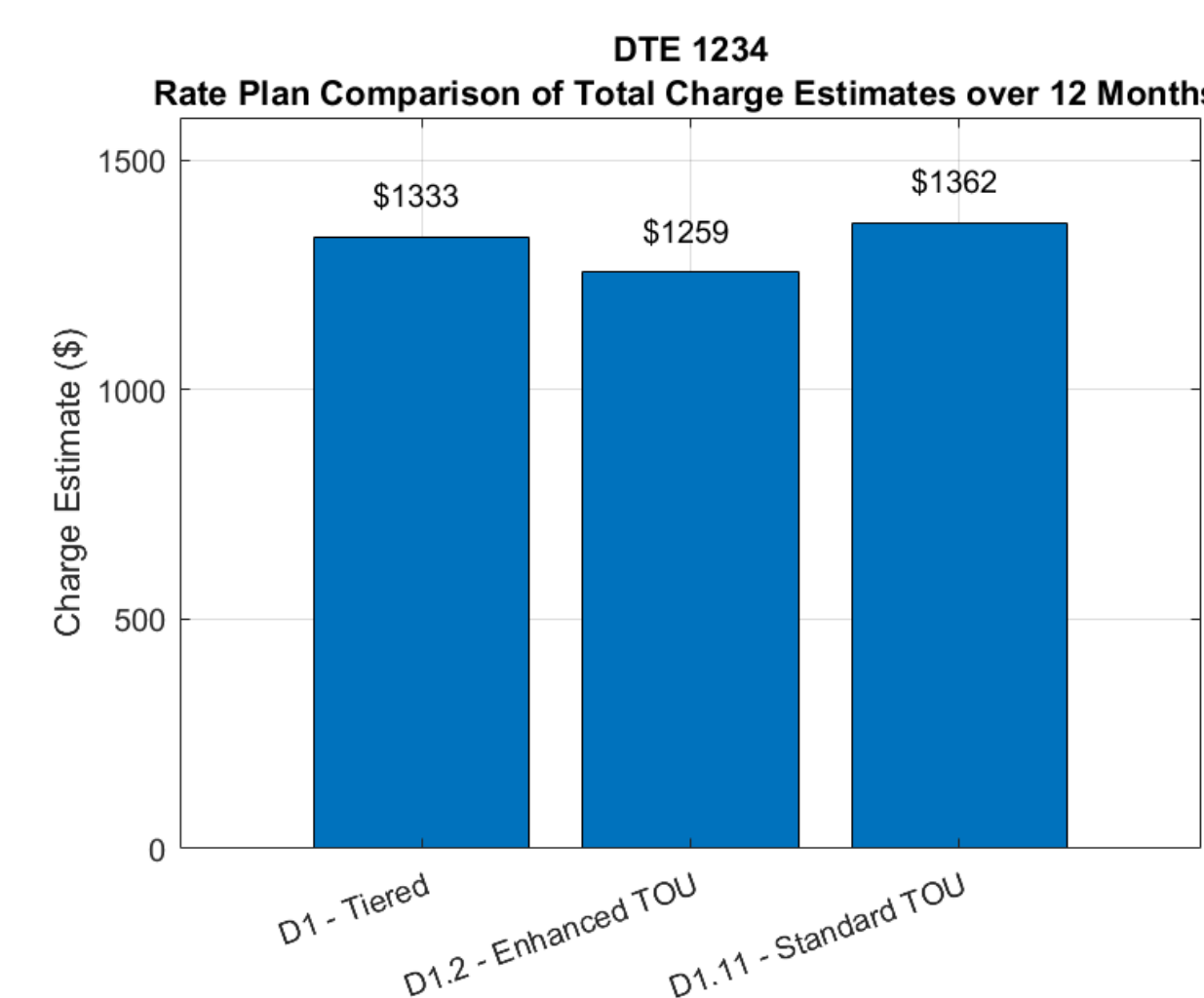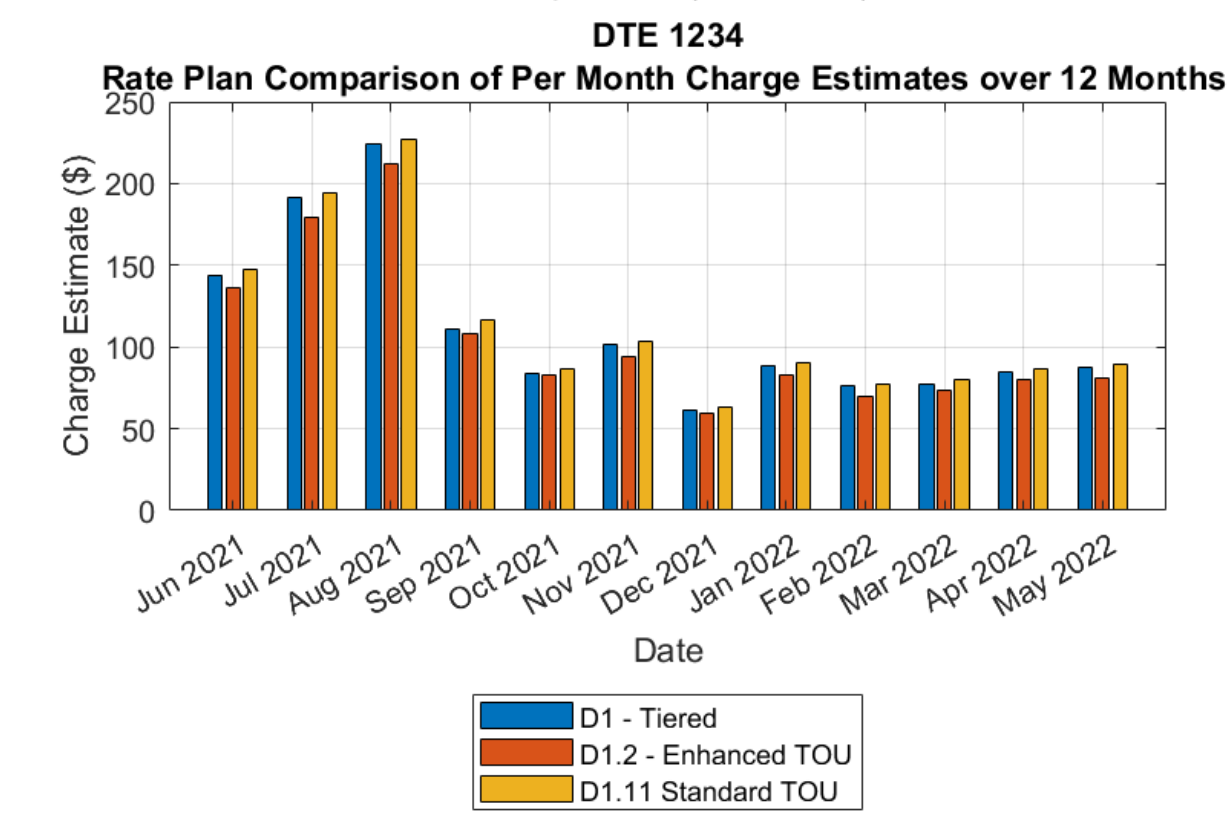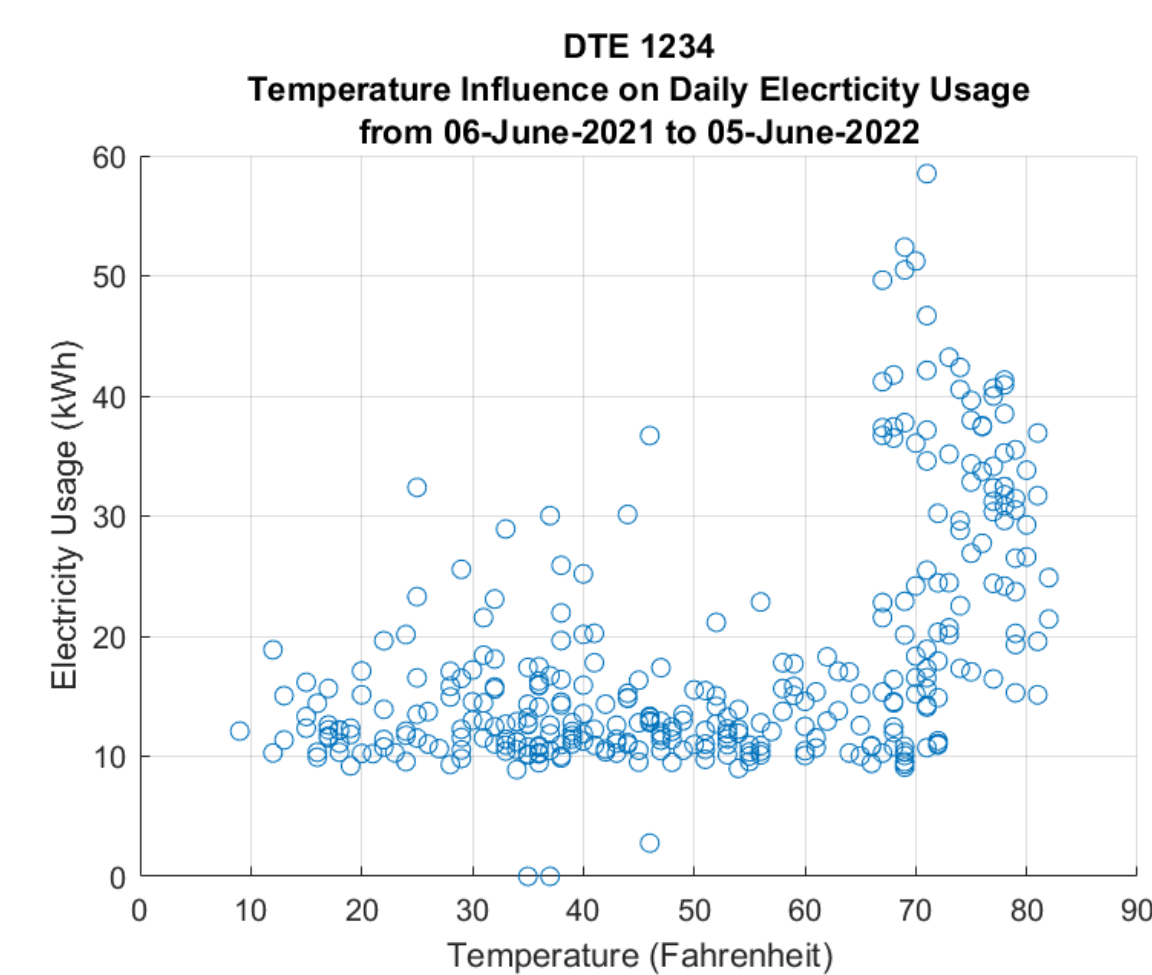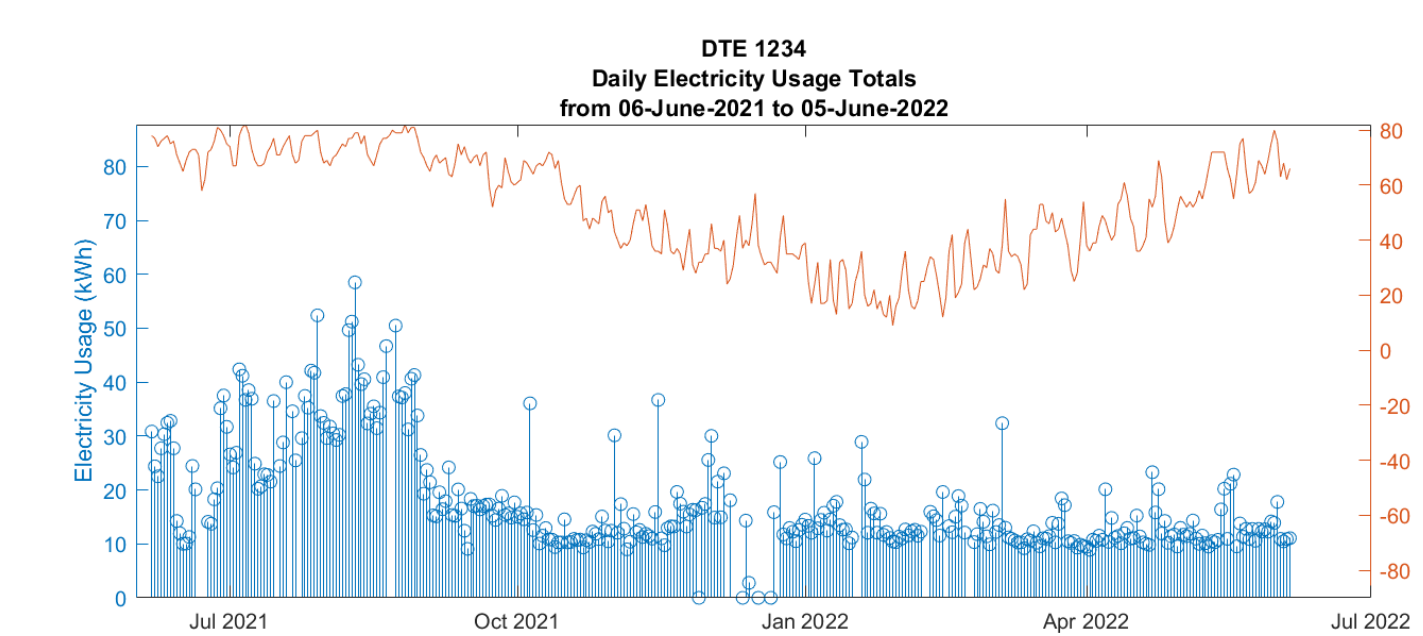
Figure 1.b - A Winter Day

Figure 3: Information computed using smart meter data given to ECMs. This data is what the ECMs use to help determine their recommendations to participants about which rate plans would be best for them.
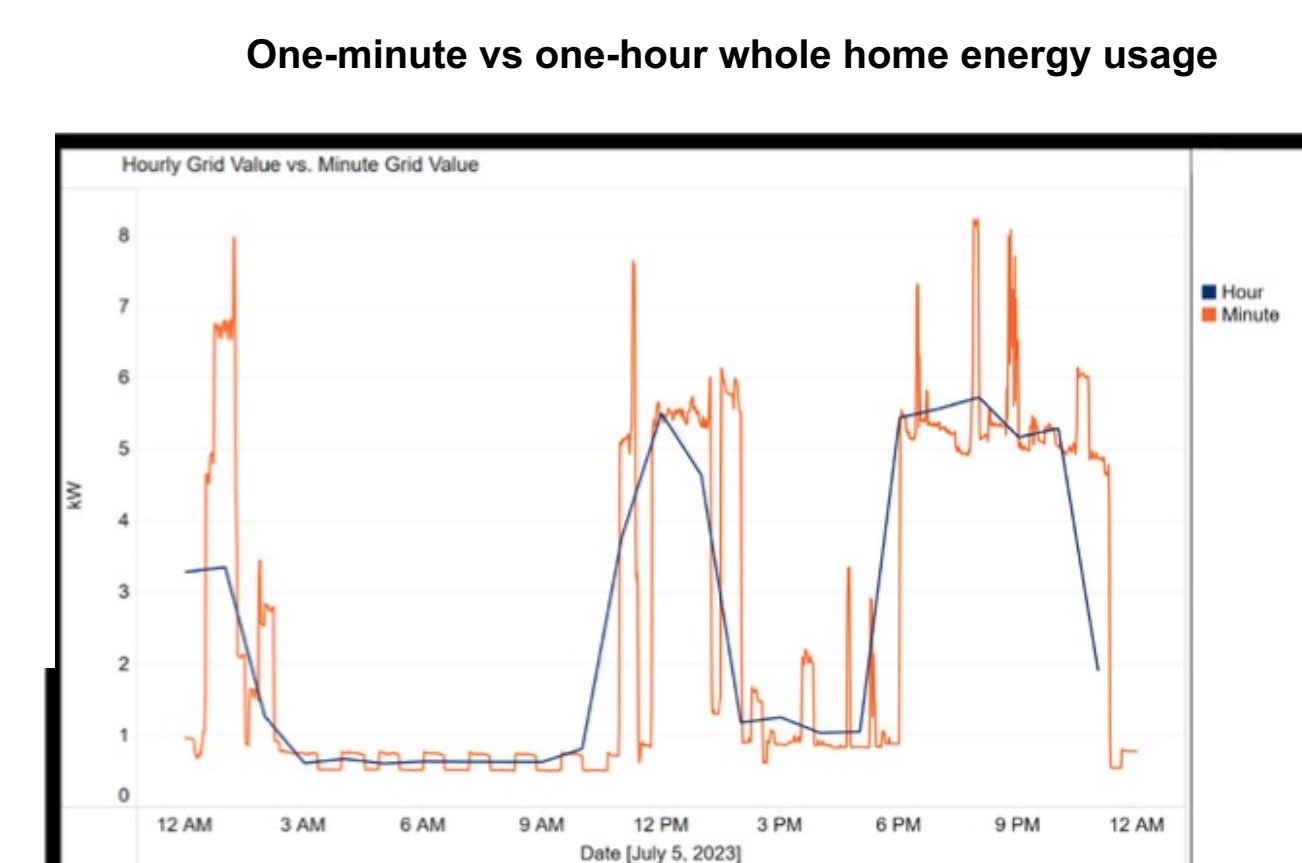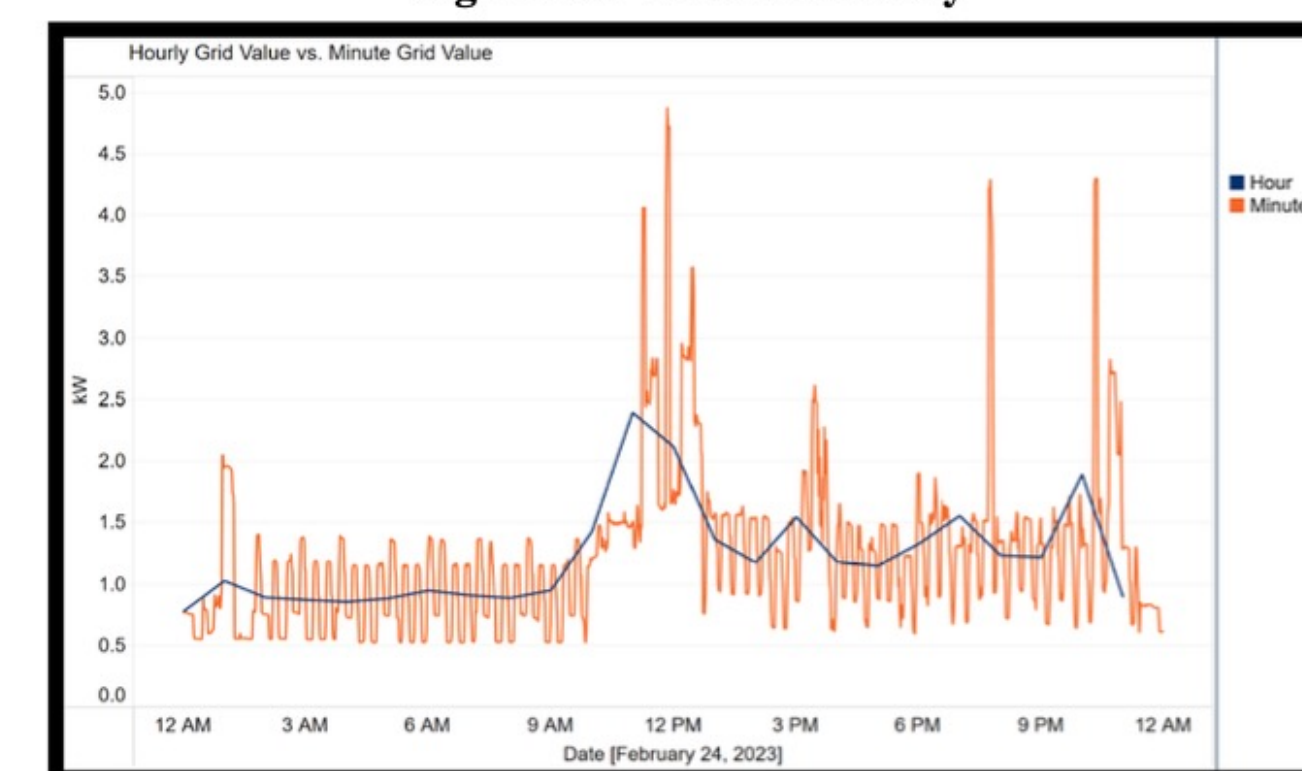

Figure 2.a - A Summer Day
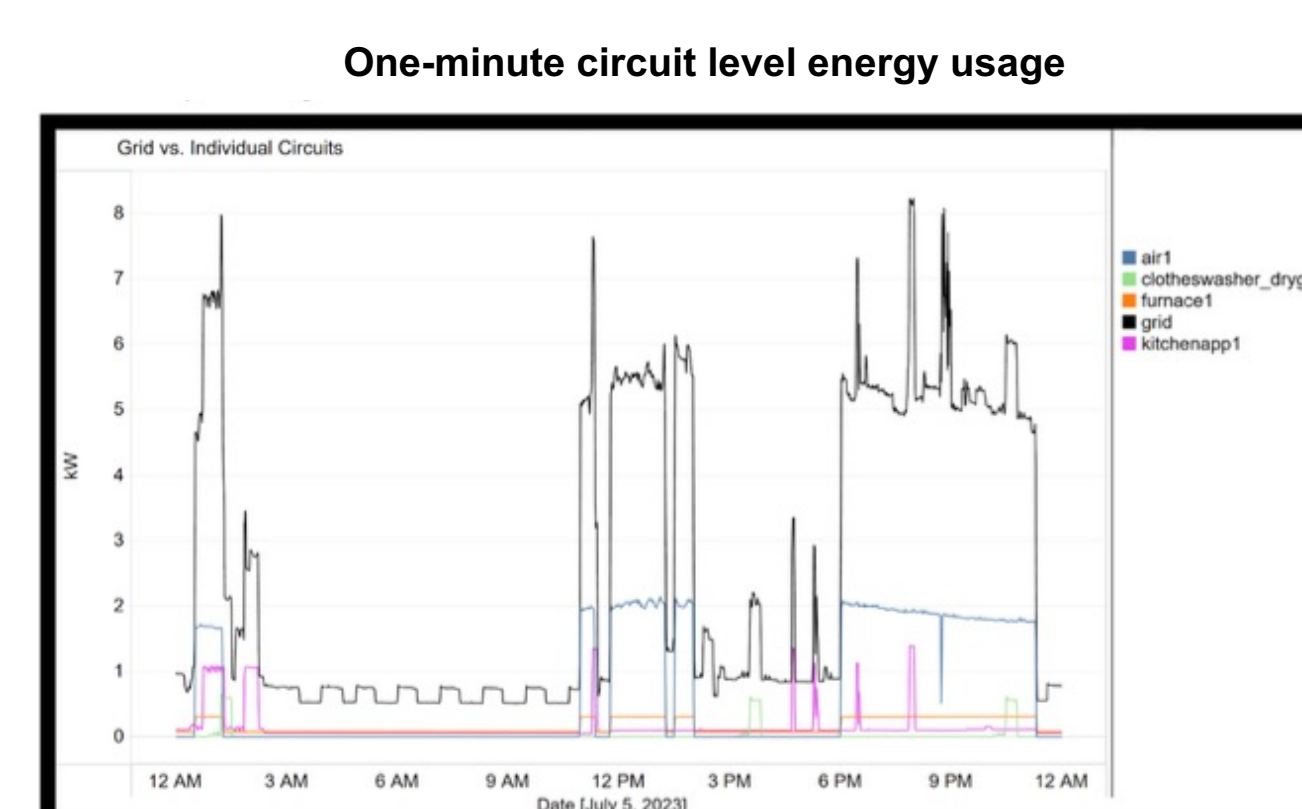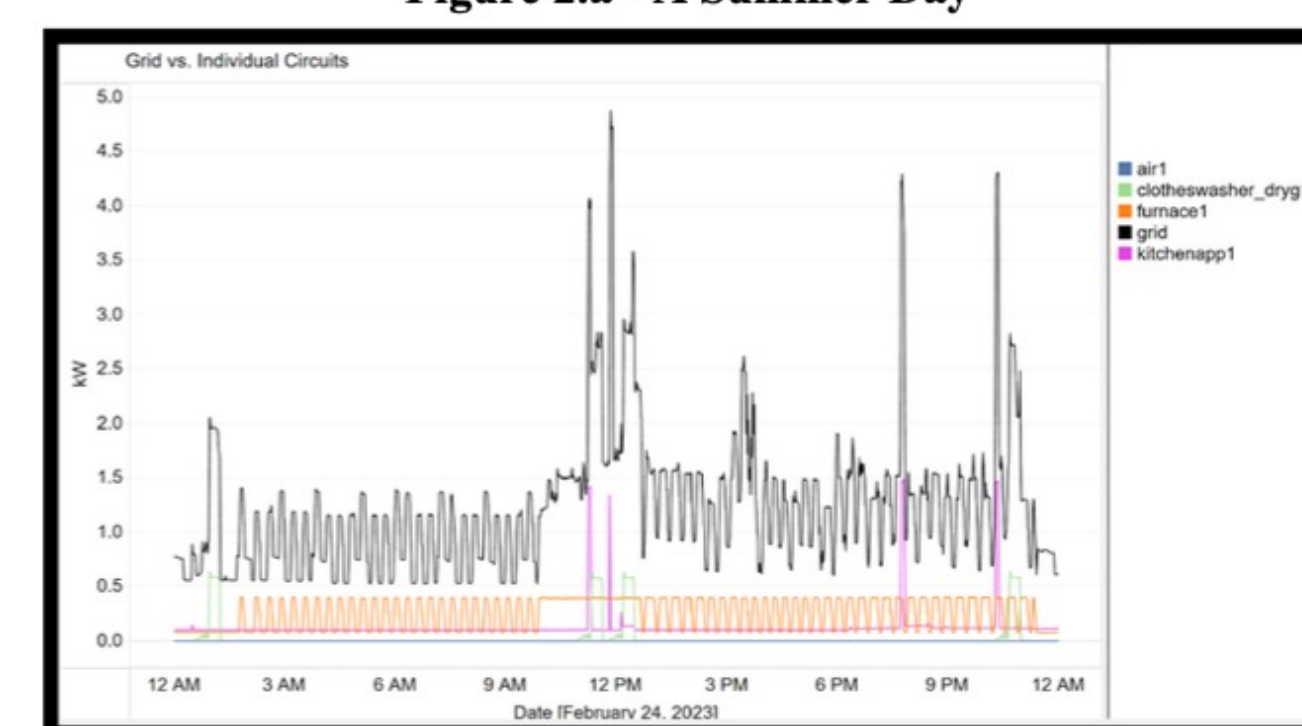
Figure 2.b - A Winter Day

Figure 4: Data from installed submeters. This is information that was shared with participants in a recent mailer along with help interpreting what it means and how it can be useful for them.

Broader Impact

Broader Impact: Immediate

- Reduced energy insecurity and burden for disadvantaged urban populations.
- Study if a community-based approach to energy efficiency is linked to reduced energy consumption, improved health and comfort, and improved sleep quality.
- Increased LMI participation in energy efficiency and renewable energy programs.
- Advancement of meaningful academic-community engagement.
- The participation of women and underrepresented minorities in interdisciplinary research.

	Villages at Parkside	Jefferson-Chalmers	Mexicantown-Southwest Detroit	Detroit, MI	Michigan
Population	1,347	7,705	11,355	690,074	9,900,571
% Black (non-Hispanic)	95.4	85.2	6.5	79.8	13.8
% White (non-Hispanic)	2.6	10.1	14.7	9.1	75.9
% Hispanic	2.0	1.4	76.9	7.7	4.7
Total housing units	491	4,104	4,144	365,528	4,539,838
Home ownership rate	15.3	52.5	50.4	49.4	71.0
Median year built	1963	1958	1939	1947	1969
Median home value	$33,600	$69,500	$32,950	$42,300	$122,400
Median household income	$11,909	$28,117	$26,670	$25,765	$49,576
% Below poverty	82.5	39.3	42.4	40.3	16.7
Unemployment rate	48.8	17.8	17.0	24.9	9.8
Internet access*	<40%	<60%	<50%	50.4%**	75%**

Sources: US Census ACS 5year 2017; *Federal Communications Commission; **ACS 1year 2017

Table 1: Demographic and housing characteristics in the three Detroit neighborhoods the study takes place in compared to the city and state.

Broader Impact: Lasting

- Energy efficiency will be used to maximize health and comfort in LMI housing and to identify how residents, community initiatives, public housing management, government, and nonprofits can fuse their efforts to reduce the energy burden on resource constrained communities.
- The knowledge created by this project can improve the design of future utility energy programs, increase equity in electricity rates, and lower overall U.S. energy consumption, thereby reducing our dependence on foreign energy sources and the overall environmental impact of the electricity sector.
- 40 submeters have been installed in partnership with Pecan Street to capture high frequency energy use data from LMI homes, a group currently underrepresented in data sets available to energy researchers.

Next Steps: Future Work

Planned Activities for the Coming Year

- Have ECMs finish the remaining follow up calls with participants to make the recommendations from Aim 1.
- Complete all exit surveys for participants and finish Aim 1 of the project.
- Begin developing algorithms to use smart and sub-metered data to identify basic energy needs a goal of Aim 2.
- Conduct deliberative workshops within the communities to help define community consensuses around basic energy needs a goal of Aim 2.
- Design new electric rates using the information gathered from the the algorithms and workshops a goal of Aim 3.