2022-2023 Georgia Smart Communities Challenge

Thomasville Heights and Norwood Manor:

Building Strategies for Energy Efficient Retrofits

Katie O'Connor, Community Research Manager | Partnership for Inclusive Innovation

Julie Ju-Youn Kim, FAIA, Professor and Chair, School of Architecture | Georgia Institute of Technology

Anuradha Kadam, Sustainability Consultant | Arup

The Partnership For Inclusive Innovation

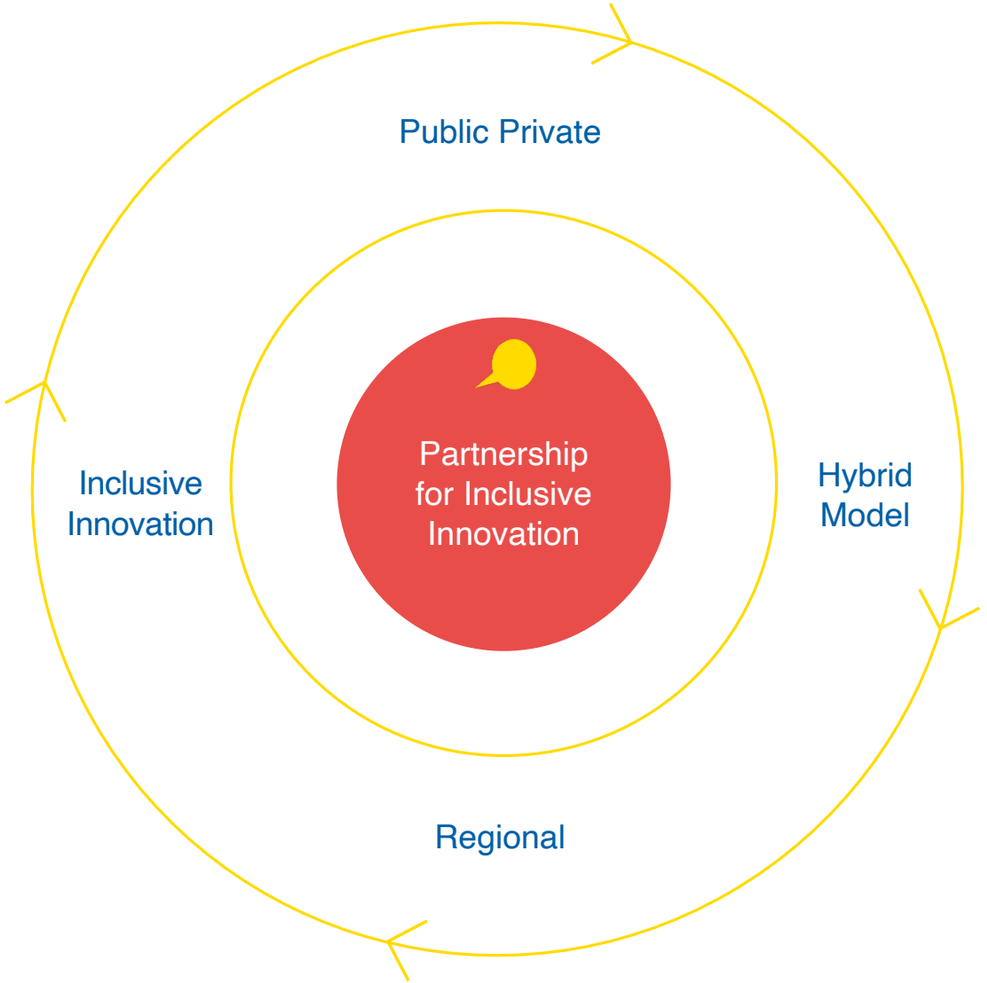
An award-winning public-private partnership that tackles the world's biggest challenges at the local level through the deployment of innovation, social and financial capital.

- Universities
- Civic Organizations
- Public and Private Sector Partners

Where We Fit

The Partnership fosters a regional connected innovation ecosystem for all. Few organizations share all four of the hallmarks to accelerate innovations that spur transformational growth and economic and community success:

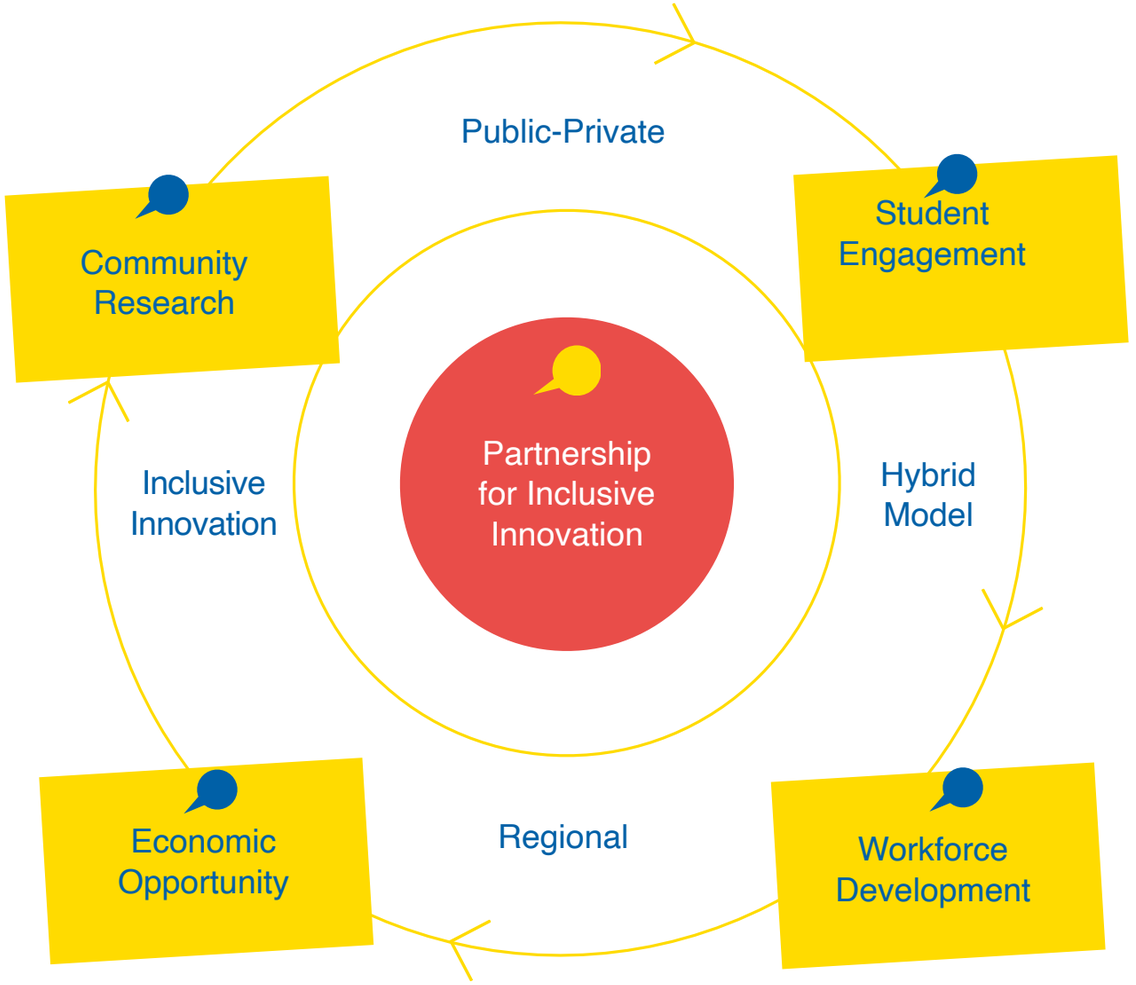
- Utilize a P3 model and multistakeholder approach
- Community-driven work and impact throughout the Southeast
- Defining and advancing inclusive innovation across geographic, racial, gender and socio-economic equity
- A hybrid model that combines grantmaking and hands-on programs



What We Do

We empower people and communities to innovate and have access to innovation in four key domains:

- Research
- Education
- Workforce Development
- Economic Opportunity



Community Research

Actively empower communities and drive the advancement of applied research through collaborative innovation, data-driven solutions and cutting-edge technology.

- Ensure that communities can harness appropriate technology, data and innovations to become more efficient, equitable and resilient
- Advanced applied, multi-disciplinary research for community benefit
- Leverage financial and social capital to support community engagement
- Foster public-private collaborations and community trust

Project Team

Project Lead	**Chanel Zeisel** (Principal Investigator)	**Beth Graham** (City Rep)	**Chandra Farley** (City Rep)	**Susana Duran** (City Rep)	**Anne Phillips** (Chair of NPU-Z)	
Research Lead Georgia Tech	**Julie Kim** (Research Lead)	**Tarek Rakha** (Research Co-Lead)	**Danielle Willkens** (Research Advisor)	**Anuradha Kadam** (Project Manager & GRA)	**Max Doersam** (GRA)	**Samantha Morton** (GRA)
Community Partner FOCUSED COMMUNITY STRATEGIES	**Pamela Stringfield** (Community Lead)	**Mikayla Santos** (Financial Lead)				
Research Partner MOREHOUSE SCHOOL OF MEDICINE	**Latrice Rollins** (Researcher)	**Kamilah Mustafa** (GRA)				
Contractor	**Bob Bird** (Founder & Admin)	**Brian Martin** (Lead Contractor)				

Julie Ju-Youn Kim, FAIA
Professor and Chair, School of Architecture
Georgia Institute of Technology

Julie is Professor and Chair at Georgia Tech's School of Architecture, where she also currently directs Flourishing Communities Collaborative, an interdisciplinary research and design lab. Since 2023, Julie has been recognized with three national awards for connecting the academy and architectural practice, creating replicable models of engagement. She holds a Bachelor of Arts from Wellesley College and a Master of Architecture from MIT.

Anuradha Kadam
Sustainability Consultant
Arup

Anuradha is currently a Sustainability Consultant at Arup, with a background in architecture and building science and experience with energy modeling, decarbonization, environmental policy, tool development, and climate action planning. Anuradha was a Jump into STEM building science competition finalist in 2021. She holds a Bachelor of Architecture from NJIT and a Master of Science in Architecture with a concentration in High Performance Buildings from Georgia Tech.

Introduction

This project is fundamentally about energy burden – this is when a significantly large amount household income is spent on energy and utility bills. Disadvantaged communities bear the brunt of this economic challenge.

Research Academic Lead

Georgia Tech

Governmental Partner

RESURGENS 1941 1865 ATLANTA, GA.

HBCU Academic Partner

MOREHOUSE SCHOOL OF MEDICINE

Non-Profit Community Partner

FOCUSED COMMUNITY STRATEGIES

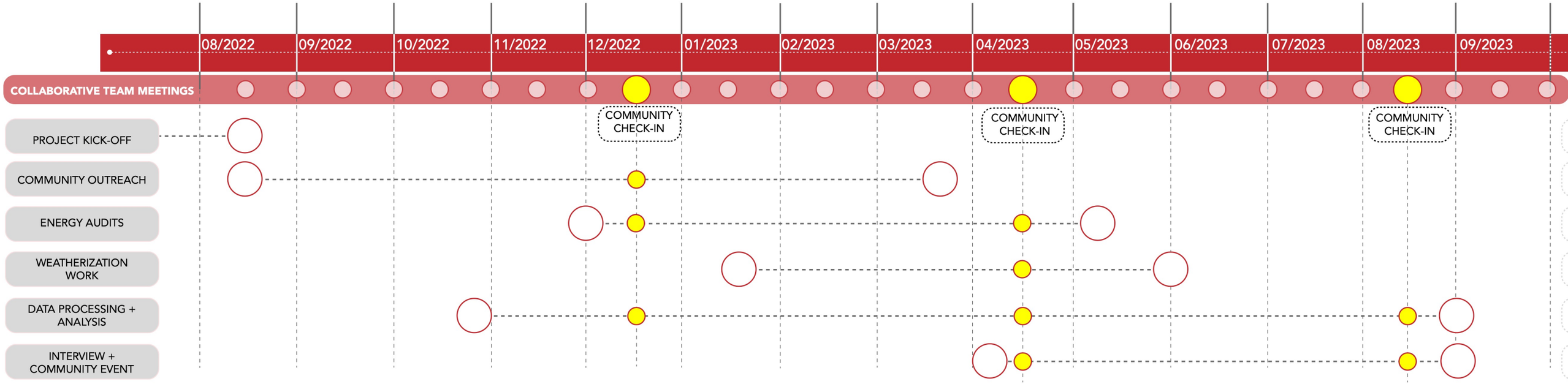
Aligned with the Partnership's mission, our project activates collaborations between researchers and municipalities to explore innovative uses of technology and data in pursuit of prosperity for all.

Thomasville Heights & Norwood Manor ranks top 7% for energy burden statewide

What is WEATHERIZATION?

Weatherization are measures to protect a building and its interior from the elements in order to reduce energy use and to increase comfort.

According to NREL, energy-efficiency and weatherization programs could save low-to-moderate-income (LMI) households up to 35% in energy consumption



The project aims to invest in household energy efficiency through non-invasive diagnostic techniques that could help achieve significant cost savings at a community scale

- Reduce Energy Consumption & Cost
- Improve Resident Health & Comfort
- Alleviate Energy Burden

Pilot Program Process

Pre – Retrofit Data Collection

1. Application – Building Info (Survey)
2. Historical Utility Bills (12 months)
3. Aerial Thermography
4. Energy Audit & Blower Door

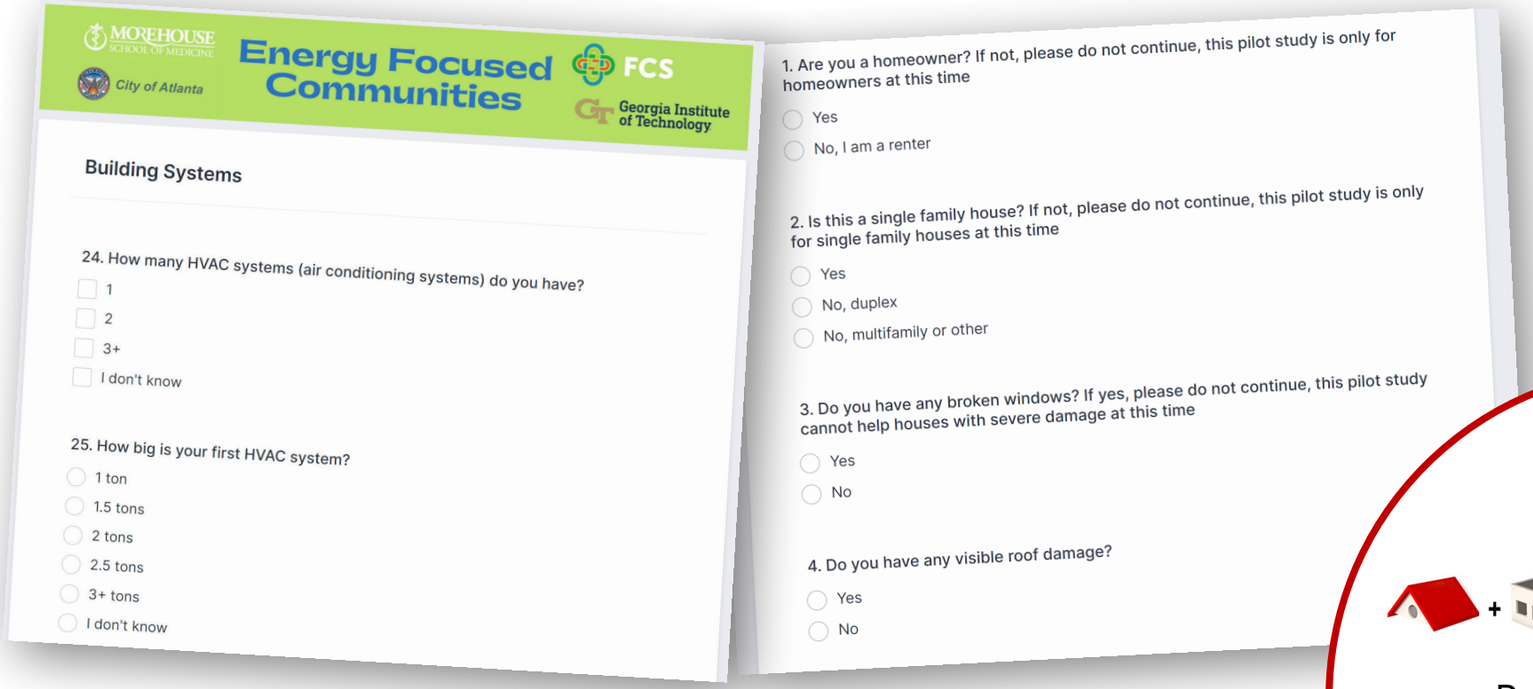
16
HOUSES ENROLLED IN THE PROGRAM

RETROFITS / WEATHERIZATION

Post – Retrofit Data Collection

1. Retrofit & Blower Door Results
2. Occupant Comfort & Feedback (Interviews)
3. Aerial Thermography
4. Utility Bills (3+ months)

4
COMMUNITY ENGAGEMENT EVENTS



Building Envelope
Separates the exterior and interior of a building and includes walls, roof, windows, and foundation.

The application form was used to determine eligibility for this pilot program and collect building data before retrofit.

Eligible homes are: (a) single family, (b) homeowner occupied, (c) provide at least 12 months of utility bills, and (d) have a complete building envelope.

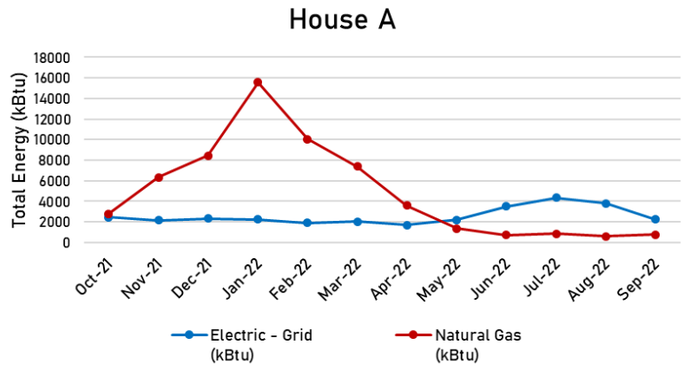
Other building data collected includes: (a) age of building, appliances, and systems, (b) building info such as rooms, floor levels, etc., (c) current occupant comfort and health, (d) type of insulation

Georgia Power

Date	Transaction	Billing Period	Due Date	Balance Forward	Transaction Amount	Amount Due	Current Actual Bill	Budget Bill Diff	RDG/Type	Days Used	Usage KWH	Bill Demand
5/13/2021	Balance Forward			$0.00								
5/13/2021	Electric Service	4/14/2021 5/13/2021			$68.41				0027449		478	
5/13/2021	Regular Bill		05/27			$68.41				29		
5/18/2021	Payment				$(68.41)							
6/14/2021	Balance Forward			$0.00								
6/14/2021	Electric Service	5/13/2021 6/14/2021			$121.06				0028294		845	
6/14/2021	Regular Bill		06/28			$121.06				32		
6/17/2021	Payment				$(121.06)							
7/14/2021	Balance Forward			$0.00								
7/14/2021	Electric Service	6/14/2021 7/14/2021			$182.72				0029517		1223	
7/14/2021	Regular Bill		07/28			$182.72				30		
7/20/2021	Payment				$(182.72)							
8/13/2021	Balance Forward			$0.00								
8/13/2021	Electric Service	7/14/2021 8/13/2021			$237.15				0031064		1547	
8/13/2021	Regular Bill		08/27			$237.15				30		
8/18/2021	Payment				$(237.15)							
9/14/2021	Balance Forward			$0.00								
9/14/2021	Electric Service	8/13/2021 9/14/2021			$216.25				0032480		1416	
9/14/2021	Regular Bill		09/28			$216.25				32		
9/17/2021	Payment				$(216.25)							
10/13/2021	Balance Forward			$0.00								
10/13/2021	Electric Service	9/14/2021 10/13/2021			$99.11				0033253		773	
10/13/2021	Regular Bill		10/27			$99.11				29		
10/18/2021	Payment				$(99.11)							
11/11/2021	Balance Forward			$0.00								
11/11/2021	Electric Service	10/13/2021 11/11/2021			$82.78				0033863		610	
11/11/2021	Regular Bill		11/29			$82.78				29		
11/16/2021	Payment				$(82.78)							

SCANA ENERGY

Bill Date	Days of Service	Heating Degree Days	Gas Used (Therms)	Balance Forward	Guaranteed Bill Amo	Other Charges	Promotional Discour	Taxes	Total Amount
2023/05/17	29	81	28.7	0	101.42			9.03	110.45
2023/04/18	32	279	49.344	0	101.42			9.03	110.45
2023/03/20	29	161.5	42.271	0	101.42			9.03	110.45
2023/02/17	30	468.5	87.72	0	84.62			7.54	92.16
2023/01/19	32	536	116.277	0	84.62			7.54	92.16
2022/12/19	30	372.5	90.816	0	84.62			7.54	92.16
2022/11/16	29	102	35.156	0	84.62			7.54	92.16
2022/10/18	32	8.5	8.28	0	84.62			7.19	91.81
2022/09/16	30	0	7.245	0	84.62			7.19	91.81
2022/08/17	32	0	9.297	0	84.62			7.19	91.81
2022/07/18	30	0	8.272	0	84.62			7.19	91.81
2022/06/16	30	2.5	13.364	0	84.62			7.19	91.81
2022/05/17	32	83	47.288	0	84.62			7.19	91.81
2022/04/18	29	229.5	72.1	0	84.62			7.54	92.16
2022/03/18	29	293.5	79.387	0	84.62			7.54	92.16
2022/02/17	31	682.5	104.333	0	70.08			6.24	76.32
2022/01/19	31	365	79.387	0	70.08	-3		5.97	73.05
2021/12/17	30	345.5	85.49	0	70.08	-3		5.97	73.05
2021/11/16	31	158.5	49.44	0	70.08	-3		5.97	73.05
2021/10/18	30	2.5	10.34	0	70.08	-3		5.97	73.05
2021/09/16	30	0	10.35	0	70.08	-3		5.97	73.05
2021/08/17	32	0	12.42	0	70.08	-3		5.97	73.05
2021/07/16	30	0	11.352	0	70.08	-3		5.97	73.05
2021/06/16	32	26	19.551	0	70.08	-3		5.97	73.05



Site EUI = 49.7 kBtu/sf

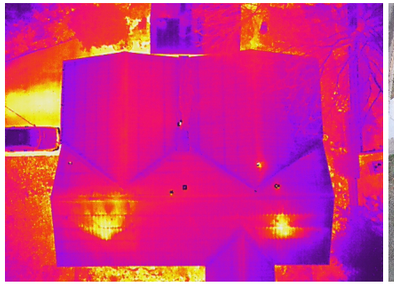
At least twelve months of electricity and natural gas data was collected from Georgia Power and SCANA energy respectively. These bills provide both usage data and cost of utilities, which varies greatly depending on the financing structure of each homeowner's utility structure.

Preparation

Drone Flight

Results

Thermal bridging



Exfiltration / Infiltration

Analyzing the images can provide a better understanding of thermal bridging, exfiltration, and infiltration in the building envelope.

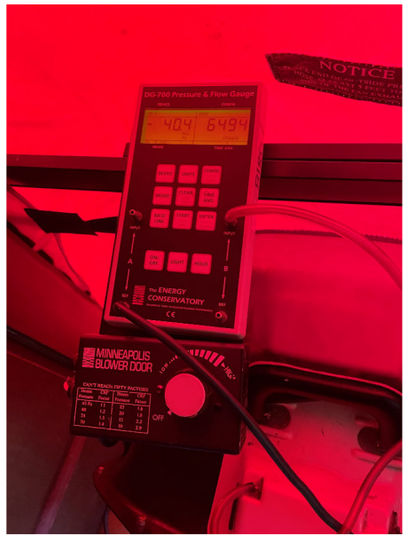
Lighting

Ductwork

Windows

Attic Insulation

Combustion Testing



Blower Door Test

An **energy audit** is a home inspection used to determine causes for the energy used and wasted in a home.

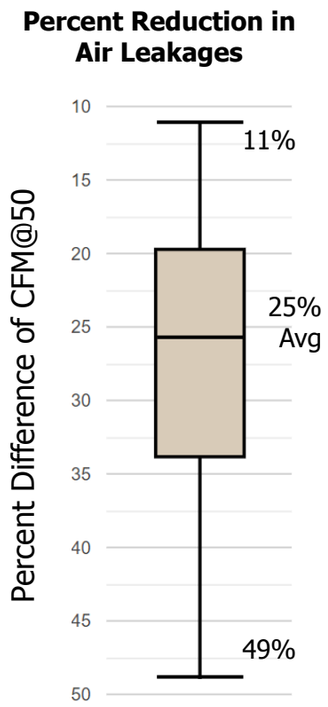
ENERGY EFFICIENCY RETROFITS

1. Install Carbon Monoxide/Smoke Alarm
2. Install LED Lighting
3. Seal and Repair Ducts
4. Add Attic Insulation
5. Weatherstrip Windows and Doors
6. Seal Cracks in Exterior Walls
7. Seal Gaps around Pipes

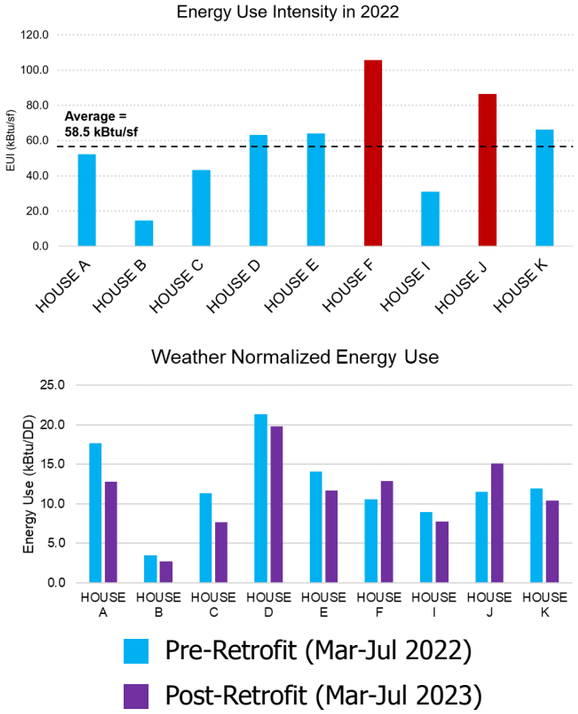
WEATHERIZATION

Data Analysis

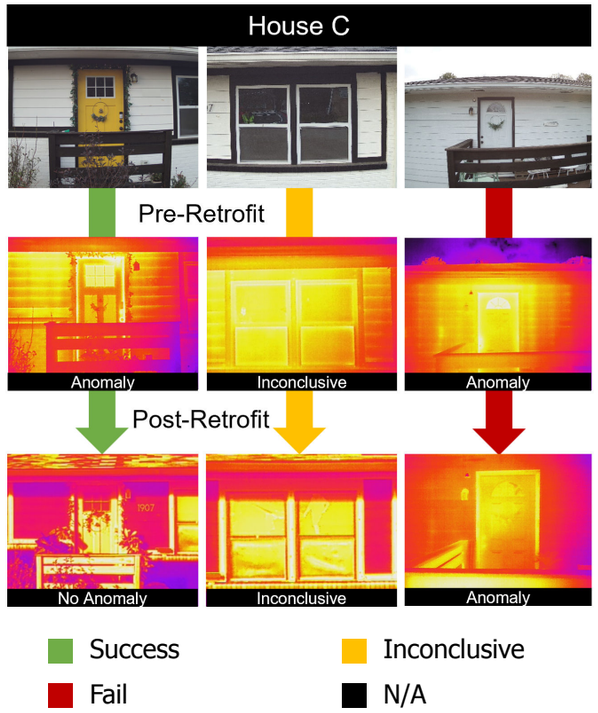
Blower Door Test



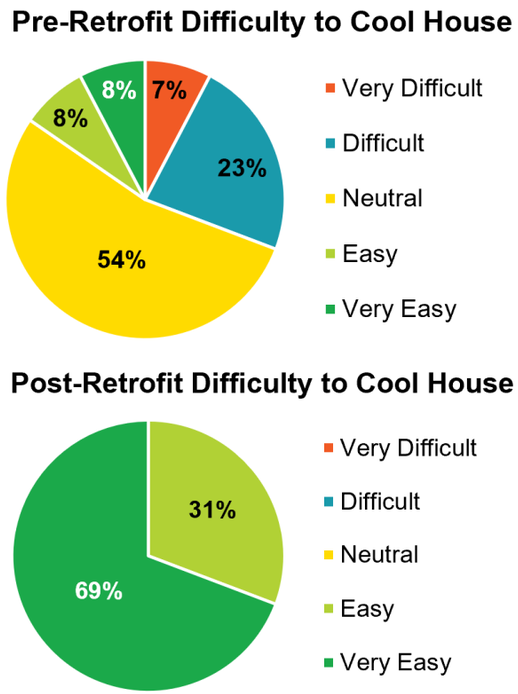
Utility Bills



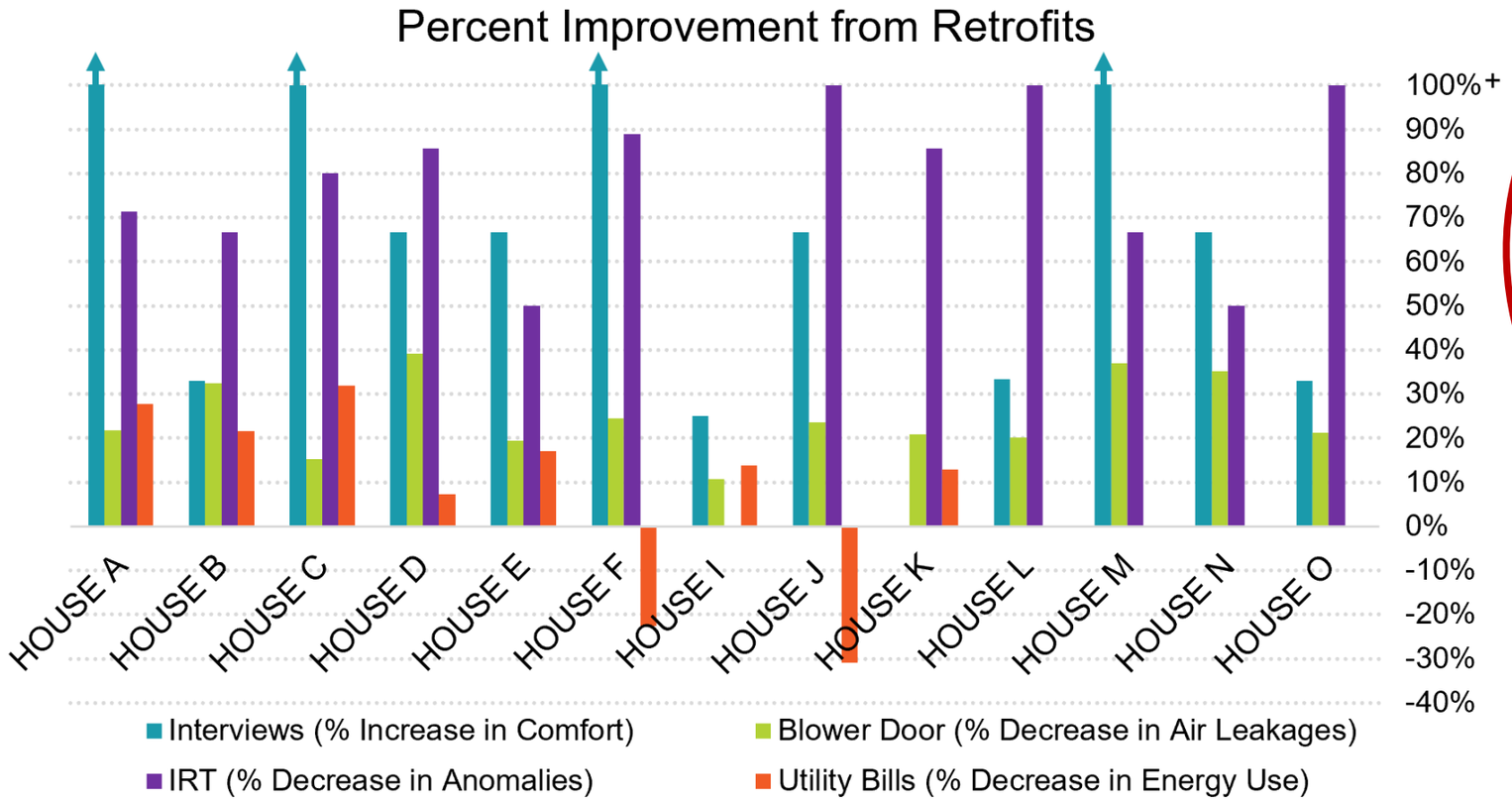
Aerial Thermography



Survey & Interview



This offers a snapshot of the data we collected pre- and post-retrofit for comparison so we could determine the impact of the weatherization.



After quantifying the difference between pre- and post-retrofit data collected for each data type, we saw overall improvement in every category on average.

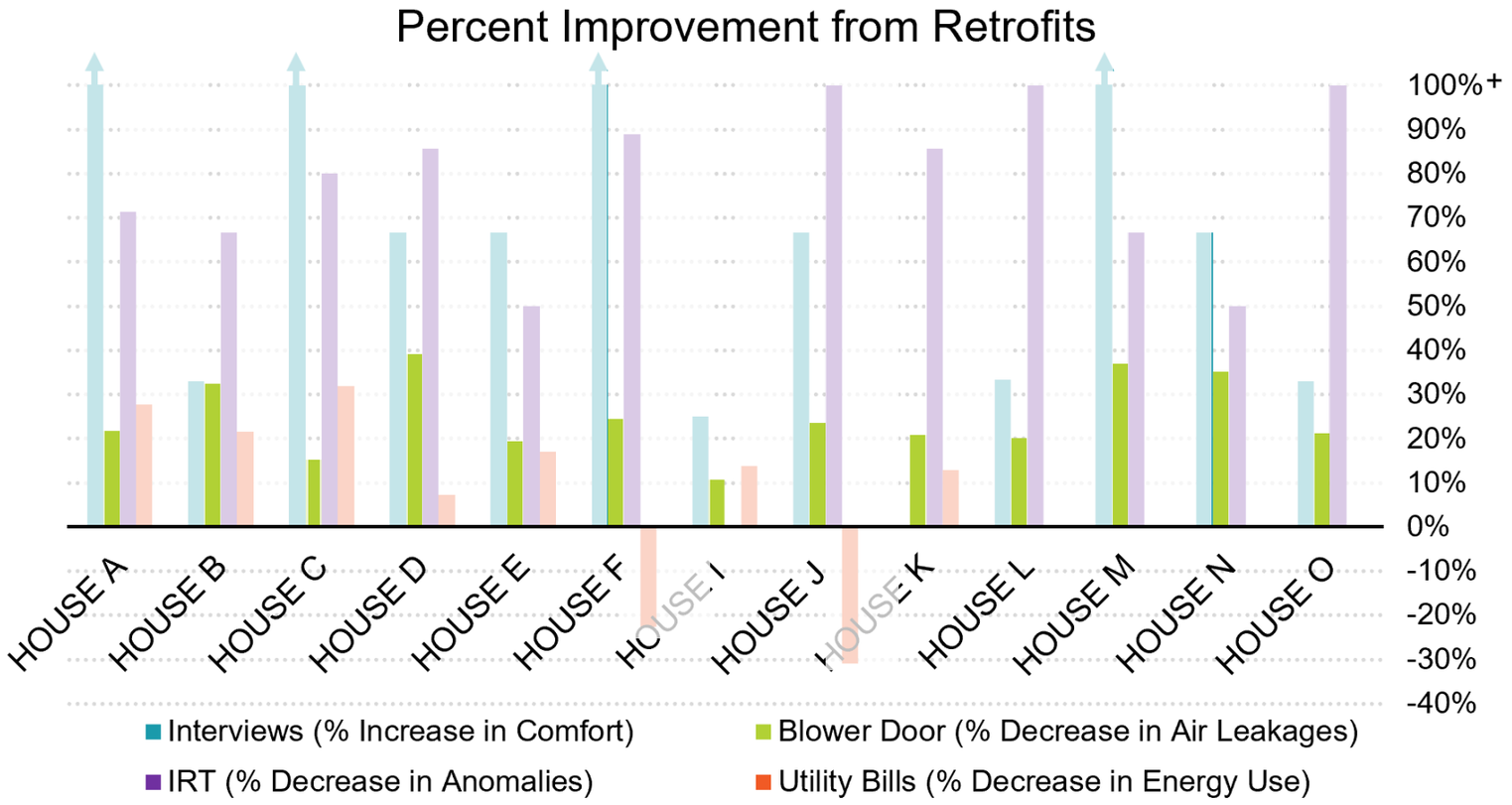
The greatest improvement seen in occupant comfort at 92% and least improvement in energy use at 9%.

25%
DECREASE IN AIR LEAKAGES

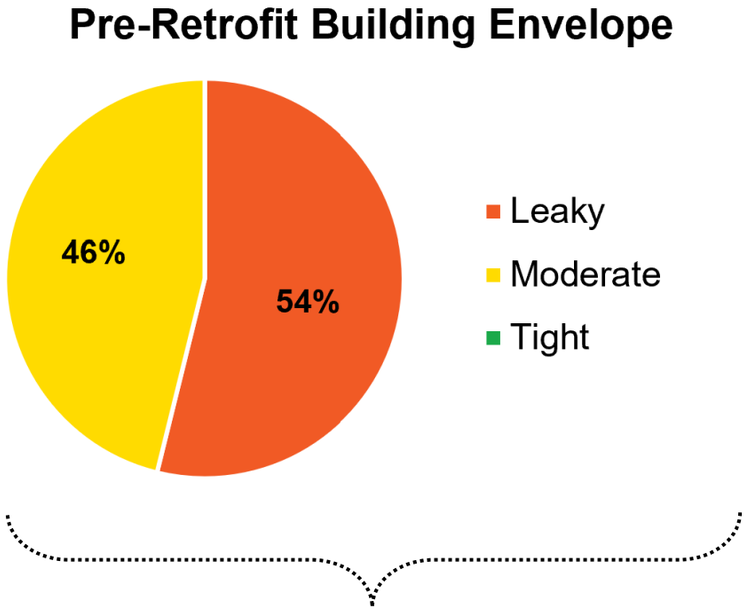
9%
DECREASE IN ENERGY USE

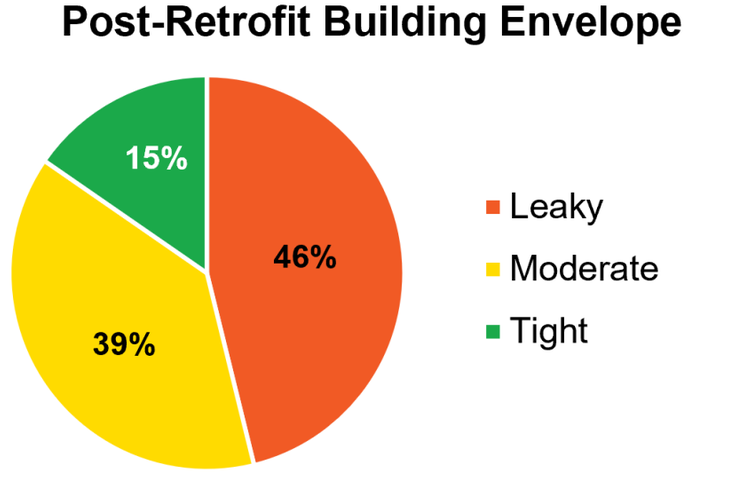
79%
DECREASE IN ANOMALIES

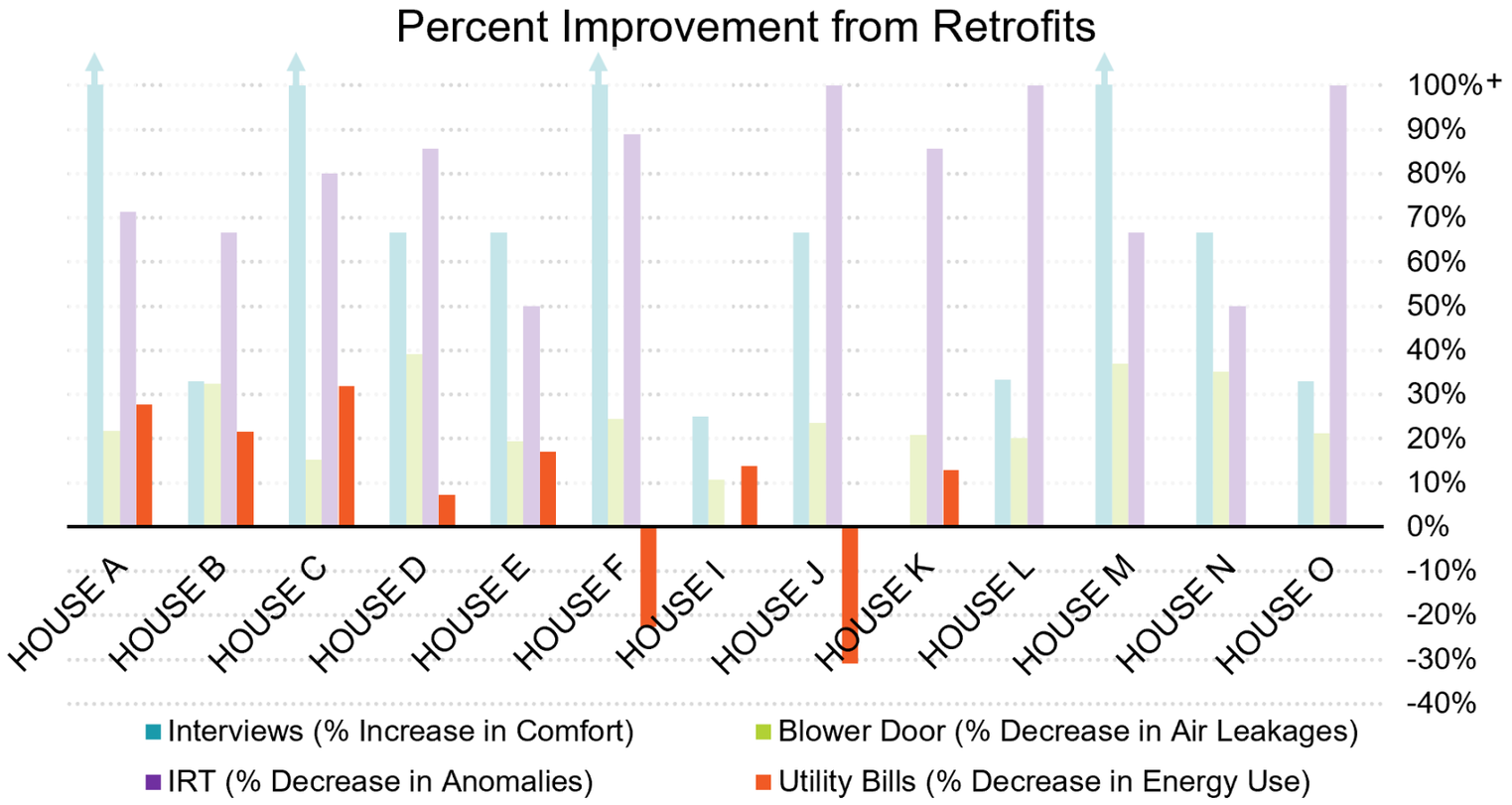
92%
INCREASE IN COMFORT

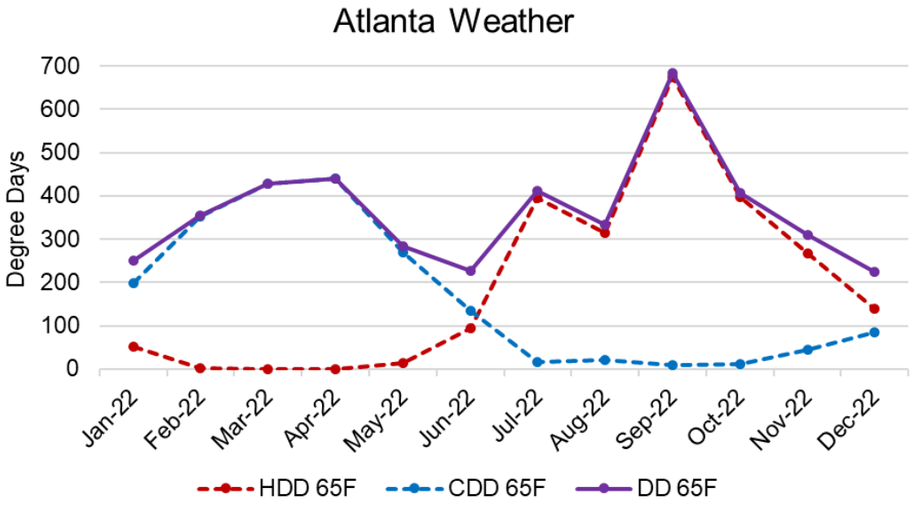


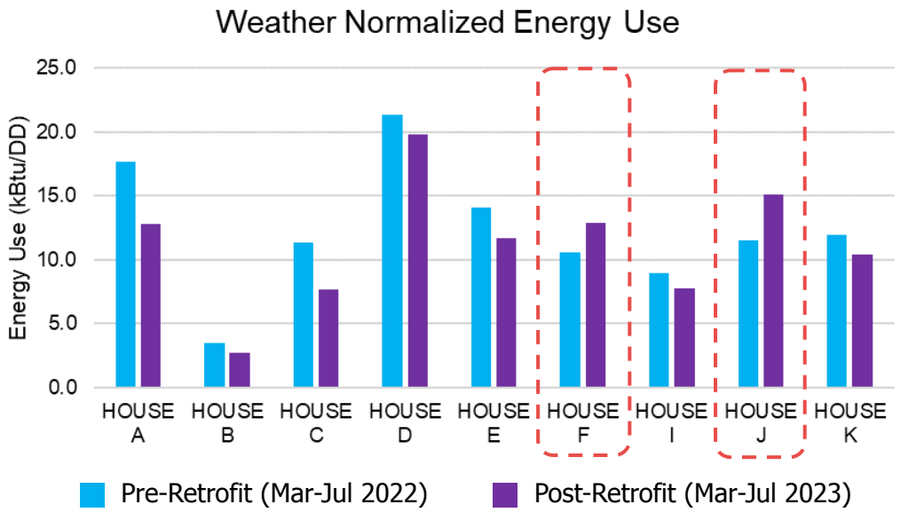
25%
DECREASE IN AIR LEAKAGES

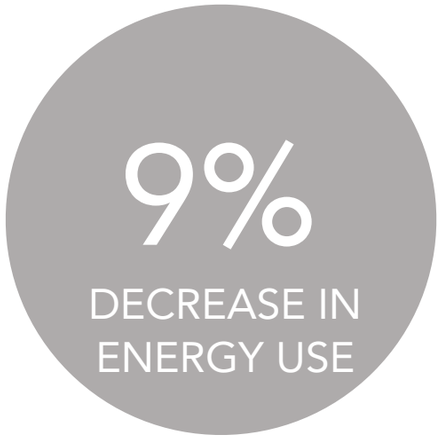


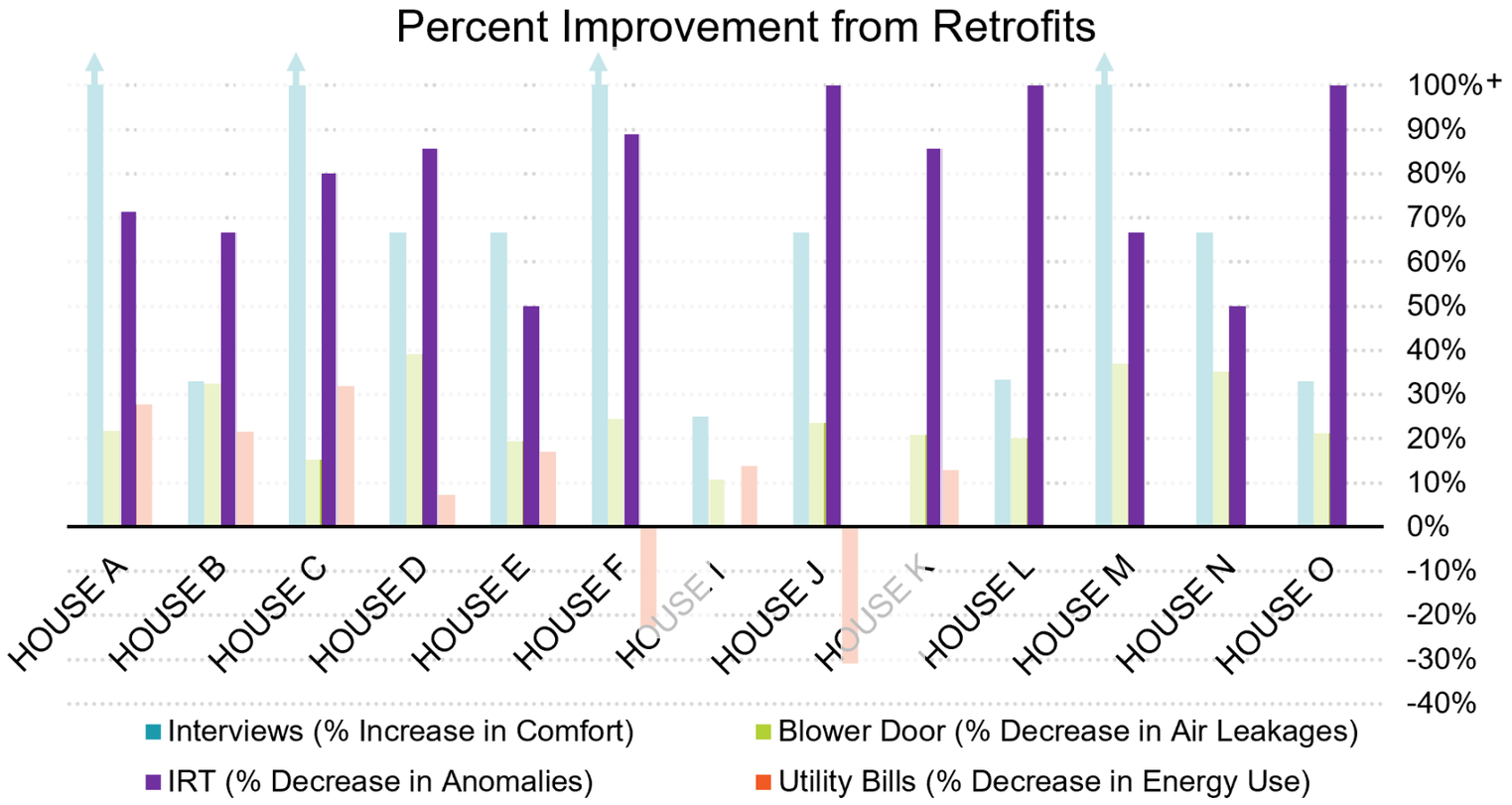


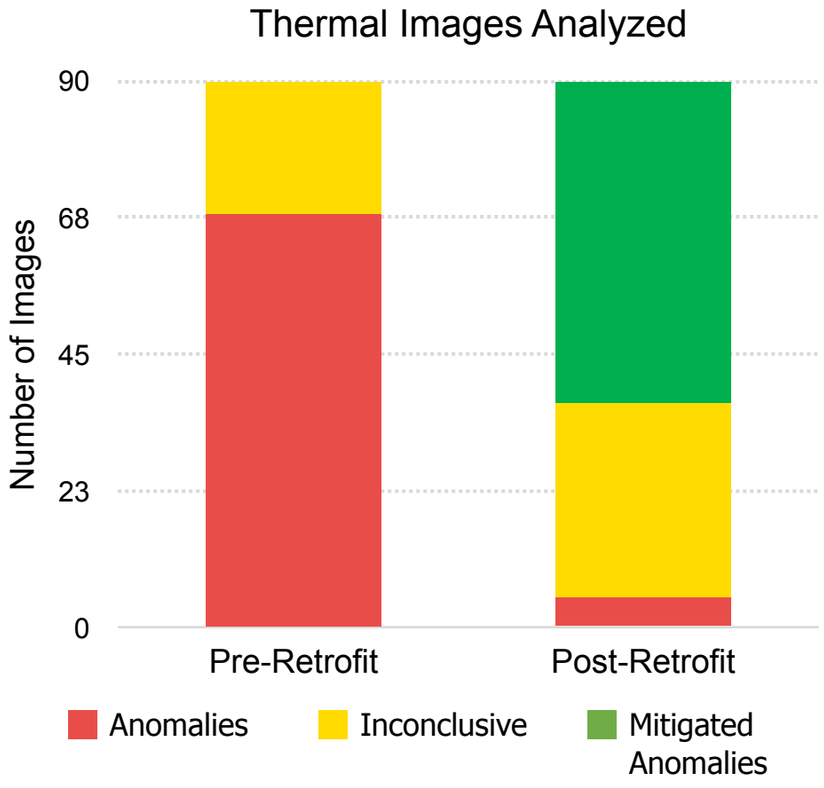

Percent Improvement from Retrofits
100%+
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
-10%
-20%
-30%
-40%
HOUSE A
HOUSE B
HOUSE C
HOUSE D
HOUSE E
HOUSE F
HOUSE I
HOUSE J
HOUSE K
HOUSE L
HOUSE M
HOUSE N
HOUSE O
Interviews (% Increase in Comfort)
Blower Door (% Decrease in Air Leakages)
IRT (% Decrease in Anomalies)
Utility Bills (% Decrease in Energy Use)


Atlanta Weather
Degree Days
700
600
500
400
300
200
100
0
Jan-22
Feb-22
Mar-22
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
HDD 65F
CDD 65F
DD 65F


Weather Normalized Energy Use
Energy Use (kBtu/DD)
25.0
20.0
15.0
10.0
5.0
0.0
HOUSE A
HOUSE B
HOUSE C
HOUSE D
HOUSE E
HOUSE F
HOUSE I
HOUSE J
HOUSE K
Pre-Retrofit (Mar-Jul 2022)
Post-Retrofit (Mar-Jul 2023)

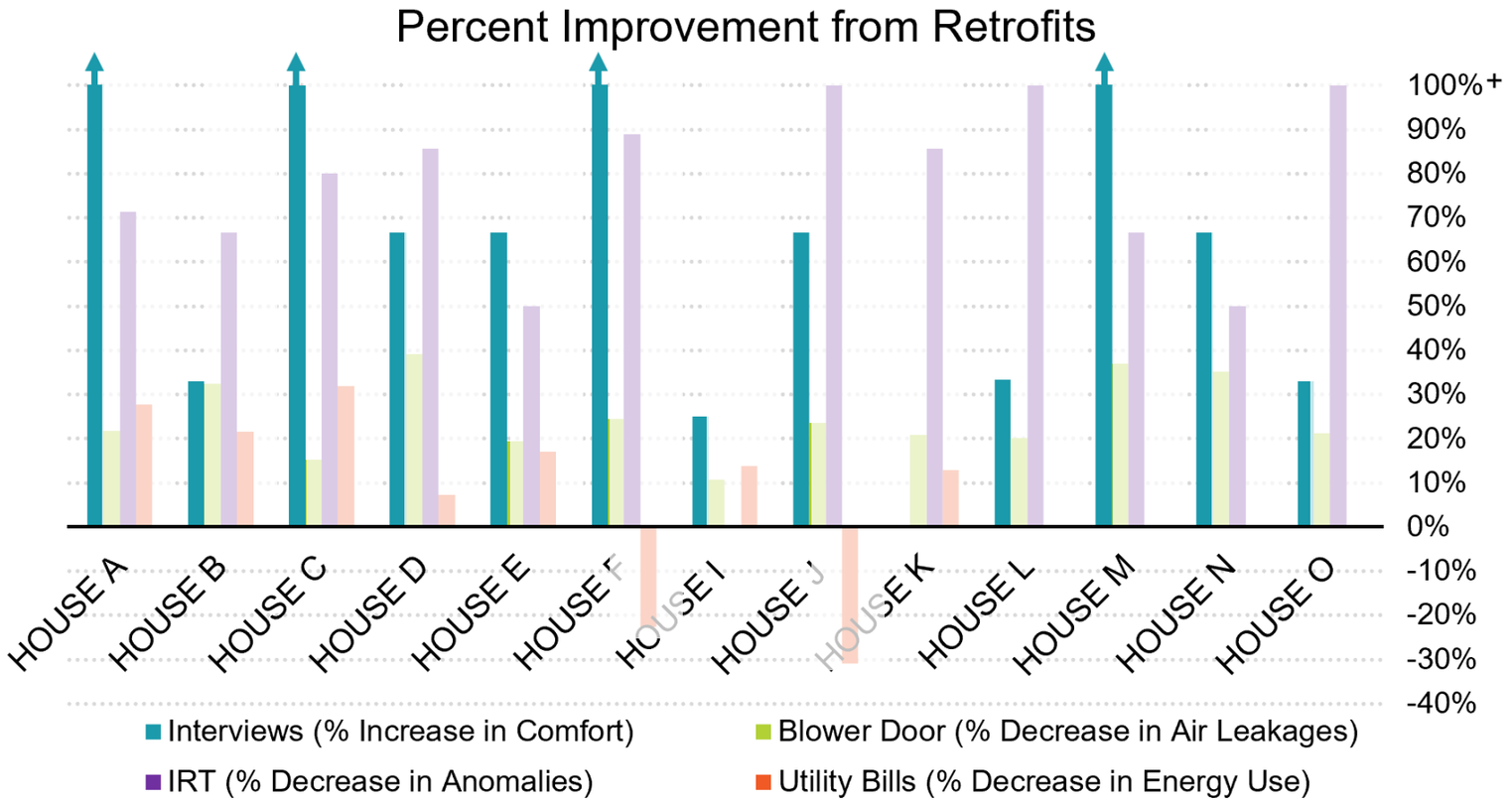

9%
DECREASE IN
ENERGY USE





79%

DECREASE IN ANOMALIES


Percent Improvement from Retrofits
100%+
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
-10%
-20%
-30%
-40%
HOUSE A
HOUSE B
HOUSE C
HOUSE D
HOUSE E
HOUSE F
HOUSE I
HOUSE J
HOUSE K
HOUSE L
HOUSE M
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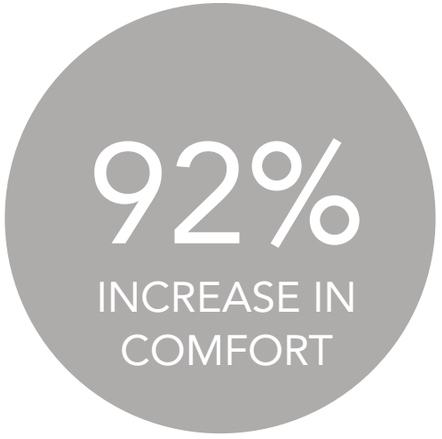
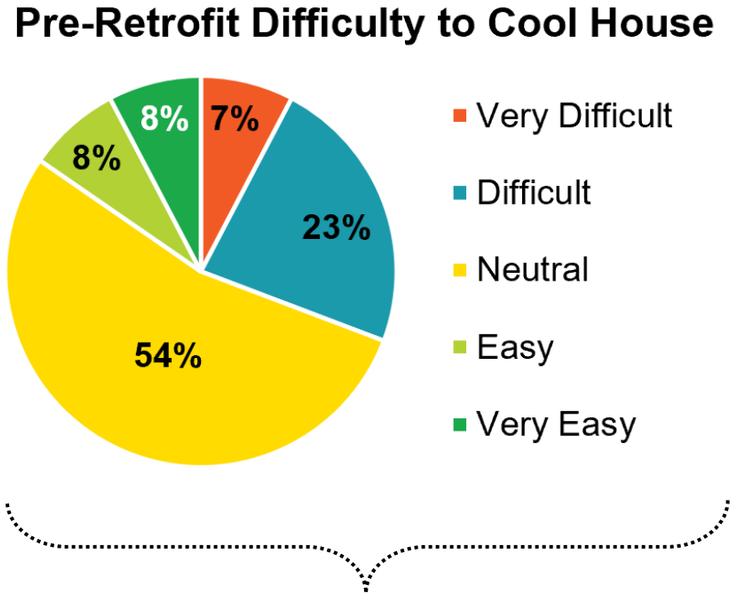
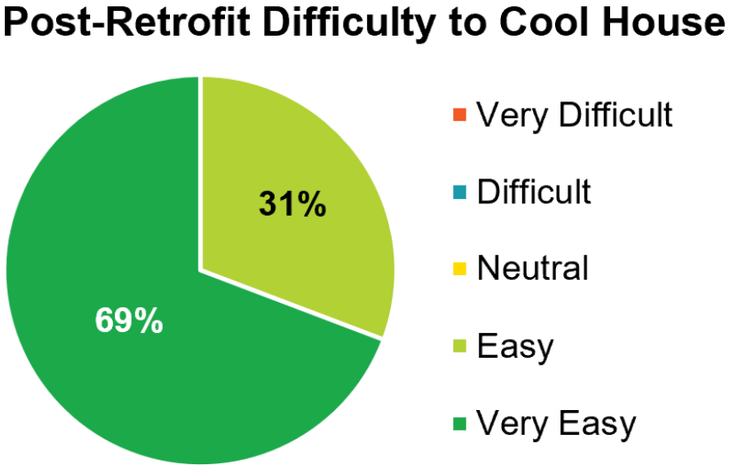
Interviews (% Increase in Comfort)
Blower Door (% Decrease in Air Leakages)
IRT (% Decrease in Anomalies)
Utility Bills (% Decrease in Energy Use)


92%
INCREASE IN
COMFORT


Pre-Retrofit Difficulty to Cool House
7%
23%
54%
8%
8%
Very Difficult
Difficult
Neutral
Easy
Very Easy


Post-Retrofit Difficulty to Cool House
31%
69%
Very Difficult
Difficult
Neutral
Easy
Very Easy

Yard Sign Placed in Community

Flyer Distributed During A Community Tabling Event and Neighborhood Meeting

Challenges

- Lack of Trust
- Accessibility of Utility Bills
- Technology Limitations

Lessons Learned

- Importance of in-person and phone call contact.
- Assistance with utility bill access during energy audit.
- Provide paper applications.

Our community partner was key in developing a connection with the residents of these neighborhoods and communicating our intention and what it means to participate in this pilot program.

Energy Focused Communities

Lunch & Learn

Join the EFC team for a free community gathering and learn key findings from our Home Energy Efficiency research in Thomasville Heights and Norwood Manor!

Thomasville Recreation Center

1835 Henry Thomas Dr SE, Atlanta, GA 30315

Enjoy Free Food, Games and Information for the Whole Neighborhood, Including:

- Soul Food Catering Serving Cajun/Creole-inspired dishes at 12:30 PM
- $100 Value Gift Baskets and Raffle Prizes
- Home Energy and Repair Information Tables

Questions or more info?

Mikayla Santos at **mikayla@fcsministries.org** or **(919) 924-5728**

Scan or Email to RSVP

Flyer Distributed for the Community Engagement Event

The event included a free meal, interactive tables with Energy Efficiency Jeopardy and close-ups of drone technology, free merchandise from partners, a presentation on the pilot program, and a raffle

Joint effort between Georgia Tech, Morehouse School of Medicine, Focused Community Strategies, and Partnership for Inclusion Innovation

This event was used as an opportunity to provide free and accessible home energy efficiency education to all community members

Conclusion

KEY TAKEAWAYS

- Low-budget retrofits and weatherization clearly have a tangible positive impact on vulnerable communities, and is the first step towards preserving legacy homeownership
- A single, sustainable, and reliable weatherization program is necessary for community members to trust, recommend to their neighbors, and continues beyond just one year
- Weatherization has the potential to contribute to long-term benefits such as health, comfort, and building envelope integrity

FUTURE OPPORTUNITIES

- Long-term post-retrofit data collection (more than 3 months) would provide more insight on long-term benefits of weatherization in underserved communities and reduction in energy burden
- Long-term occupancy and behavior data collection would provide more insight on home and energy education needed
- Better advertising and recruitment would lead to more applicants benefitting from weatherization programs
- Long term partnerships can be formed with community, residents, and utility providers such as Georgia Power to develop a more efficient process

Working side-by-side with communities, we equip residents with tools necessary to build on the power they already have. We seek to expand equity through access and empower through design and technology.

Our work demonstrates the value of a computational, quantitative, and data-driven approach to advancing equity and addressing social and cultural problems by expanding access to resources.

Thomasville Heights and Norwood Manor: Building Strategies for Energy Efficient Retrofits

Panel

Balancing Research and Real-World Implementation

As a researcher in architecture and building performance, how did you balance the technical aspects of energy efficiency with the real-world constraints of working in an existing community with limited resources? What design or implementation strategies proved to be the most practical and impactful?

Lessons for Future Programs

The data shows measurable improvements in energy efficiency and occupant comfort, but also highlights challenges such as trust-building and access to utility bills. If you were to scale this project or apply its findings to another community what key changes or improvements would you recommend to make the process smoother and more impactful?

Community Engagement & Participation

As the project manager, you worked directly with residents throughout the process. What were some of the most surprising or insightful moments from your interactions with homeowners, and how did those moments shape the way you approached implementation?

Data Collection & Impact Measurement

The post-retrofit data showed a 25% decrease in air leakage, a 9% decrease in energy use, and a 92% increase in comfort. Were there any unexpected findings in the data that challenged your initial assumptions, and how can this type of data collection be improved for future community-based energy efficiency projects?

Q&A