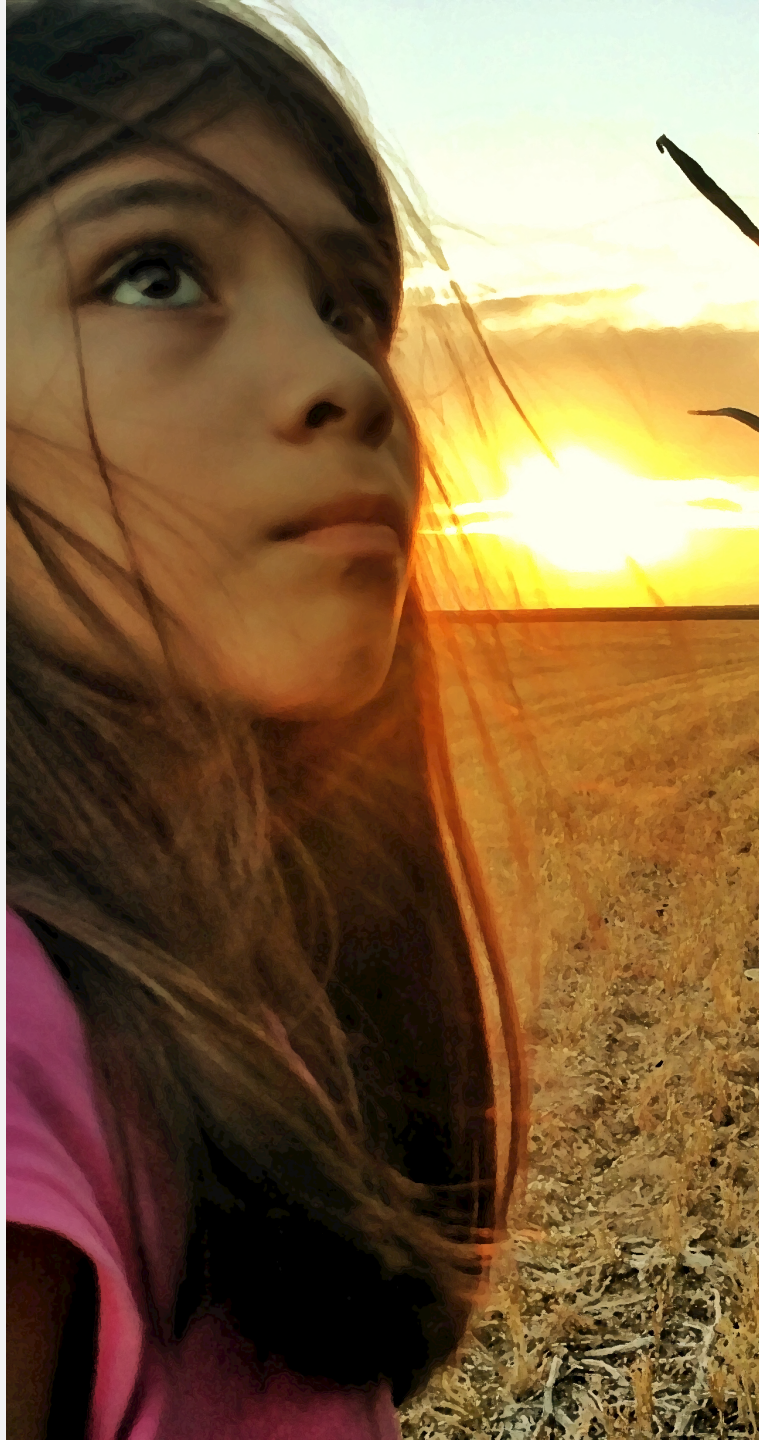
Pathways for DERs to Reduce Energy Burdens

Opportunities, barriers for energy efficiency, rooftop solar in low-income buildings | Houston

TEPRI
Texas Energy Poverty Research Institute

Webinar Supported by Energy Foundation
May 26, 2020

About TEPRI



Mission:

Inspire lasting energy solutions

Approach:

Link community voices with science, data, and innovative partnerships

Deliver best available information to decision-makers

Outcomes:

Energy poverty reduction

Economic development

Community well-being

Overview

TEPRI's *Pathways for DERs to Reduce Energy Burdens: Houston* aims to identify the optimal pathways for DERs to reduce energy burdens on low-income households in Harris County.

- Home energy can be unaffordable for households with low-incomes
- Low-income people, communities of color, other underserved populations often have limited access to the benefits of DERs
- Level of income, housing type, renter or owner status influences energy expenditures
- Energy efficiency and rooftop solar offer pathways to reduce energy burdens of low-income households
- Through data analysis and stakeholder engagement, we believe we can develop sustainable solutions to begin addressing energy burdens in Harris County

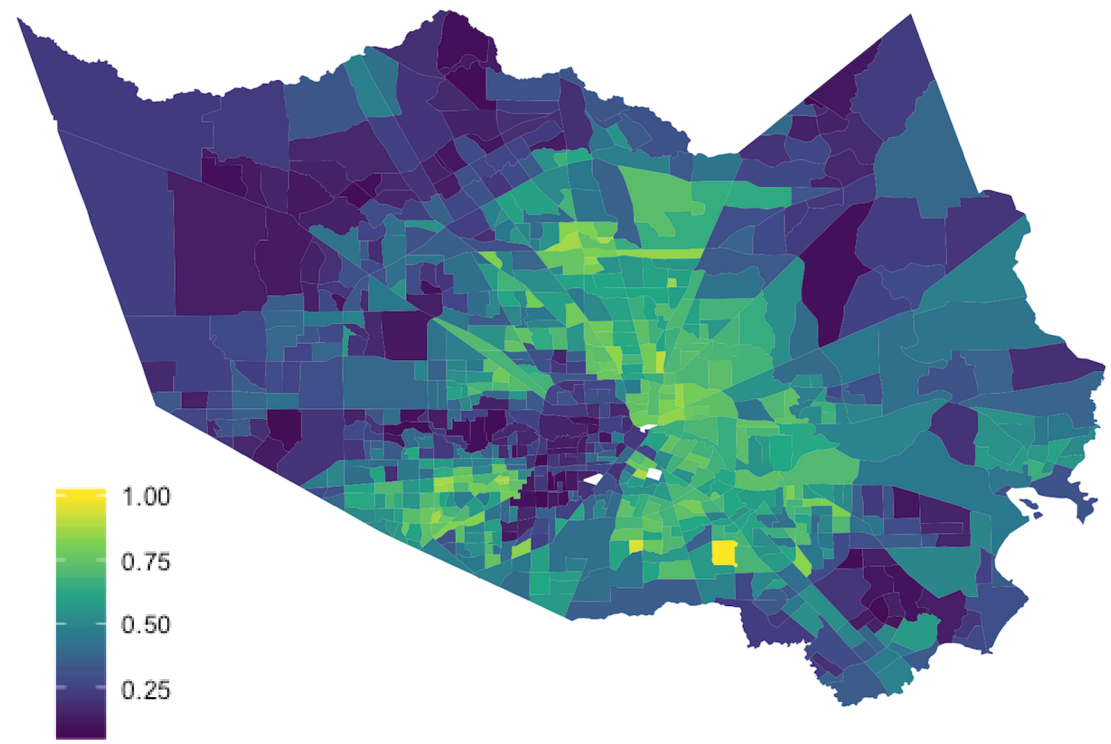
This project is graciously made possible with the support of:

ENERGY FOUNDATION
building a new energy future

Purpose

To identify the best pathways for using DERs (specifically, rooftop solar and energy efficiency) to address the energy affordability gap in Harris County.

Energy Affordability Gap: the difference between actual home energy bills and affordable home energy bills for the entire population where affordable energy is ≤6% energy burden



Portion of Households that are 0-80% AMI for Harris County of all households, by census tract (LEAD Tool)

Highlights

604,573

Number of **low-income households** in Harris County

8.1 TWh

Total low-income annual **energy consumed** in Harris County

1.8 TWh

Annual **energy efficiency** economic potential in low-income households in Harris County

5.8 TWh

Annual **rooftop solar** technical potential for low-income households in Harris County

Methodology

Phase A.
Technical Analysis

Data Collection
- LICP
- LEAD Tool
- NREL Datasets

Data Analysis
- R
- Tableau

Phase B.
Stakeholder Engagement

Discussion

Roadmap Planning

Phase C.
Pilot Program

Leverage Funding Sources

Pilot Development

Drivers of Household Energy Burden

Physical

- Building envelope
- HVAC
- Appliances
- Extreme weather

Economic

- Chronic hardship
- Sudden hardship
- Inability to invest

Policy

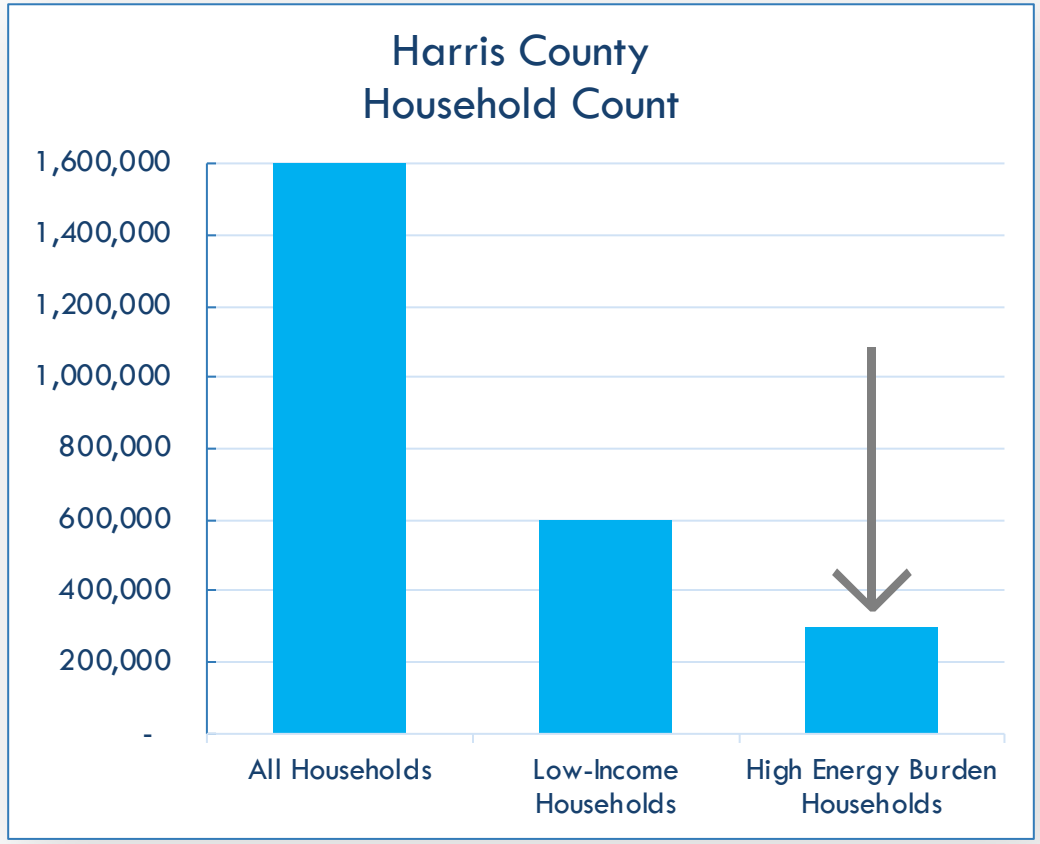
- Insufficient or inaccessible programs
- Certain rate design practices

Behavioral

- Limited program awareness
- Lack of energy conservation education
- Increased usage

Adapted from: *Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low Income and Underserved Communities,* by Ariel Drehobl and Lauren Ross

THE ENERGY AFFORDABILITY GAP



Housing Unit Count, Harris County
Source: LEAD Tool

Average Household Affordability Gap

$47 per month

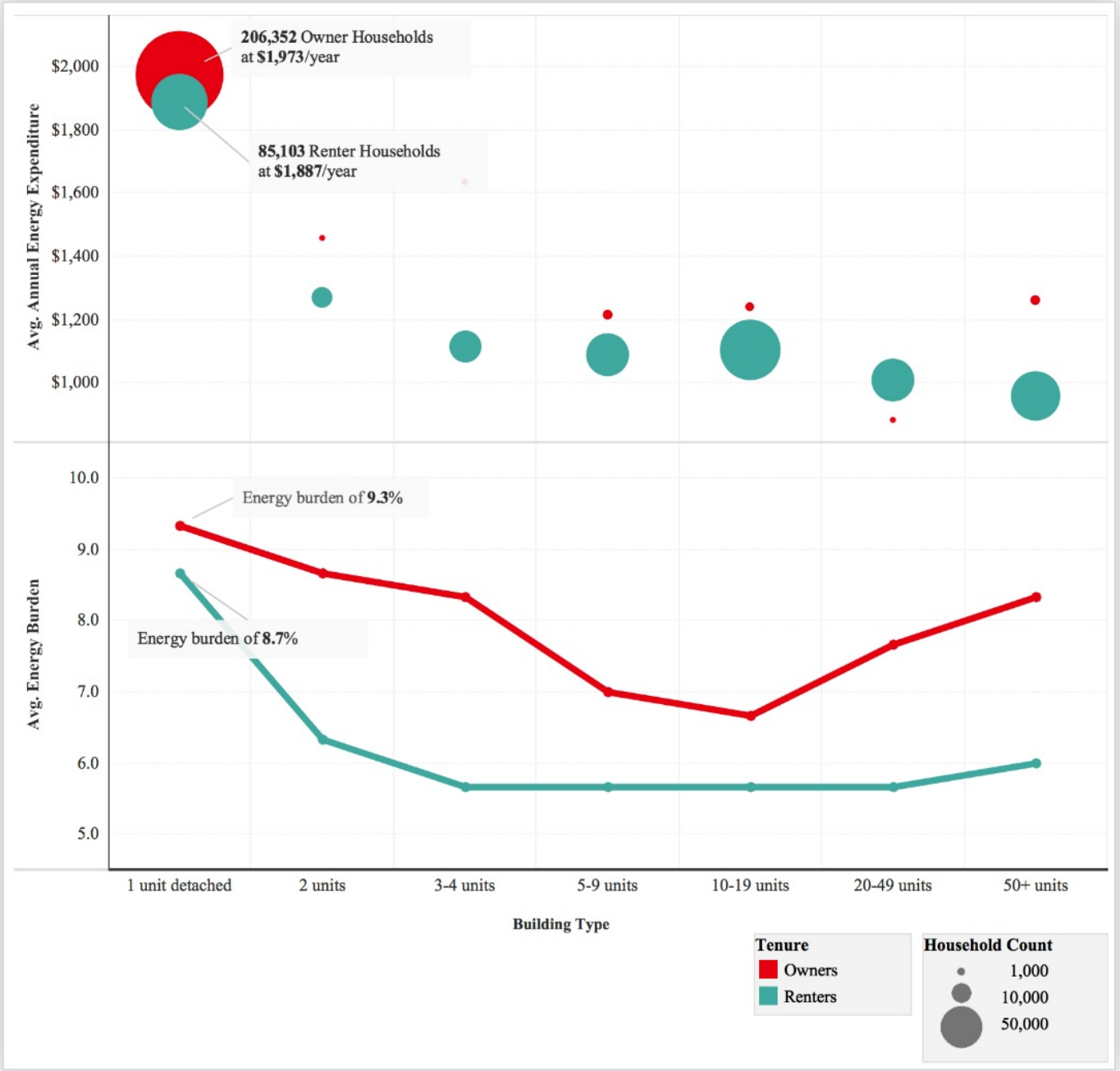
Low-Income Community Energy Affordability Gap

$200 Million per year

BUILDING TYPE, TENURE

We gleaned the following insights from the LEAD Tool related to energy costs for low-income households in Harris County.

- Highest energy costs were among households who live in **1 unit detached buildings** (i.e., single-family homes)
- **Homeowners** (red dots) consistently had higher energy costs and energy burden compared to renters (blue)



Charted by TEPRI (2020) » **Data Source:** U.S. Department of Energy, 2019, Low-Income Energy Affordability Data (LEAD), with data from the 2016 5-Year American Community Survey (U.S. Census)

Benefits of Energy Efficiency + Solar in Housing

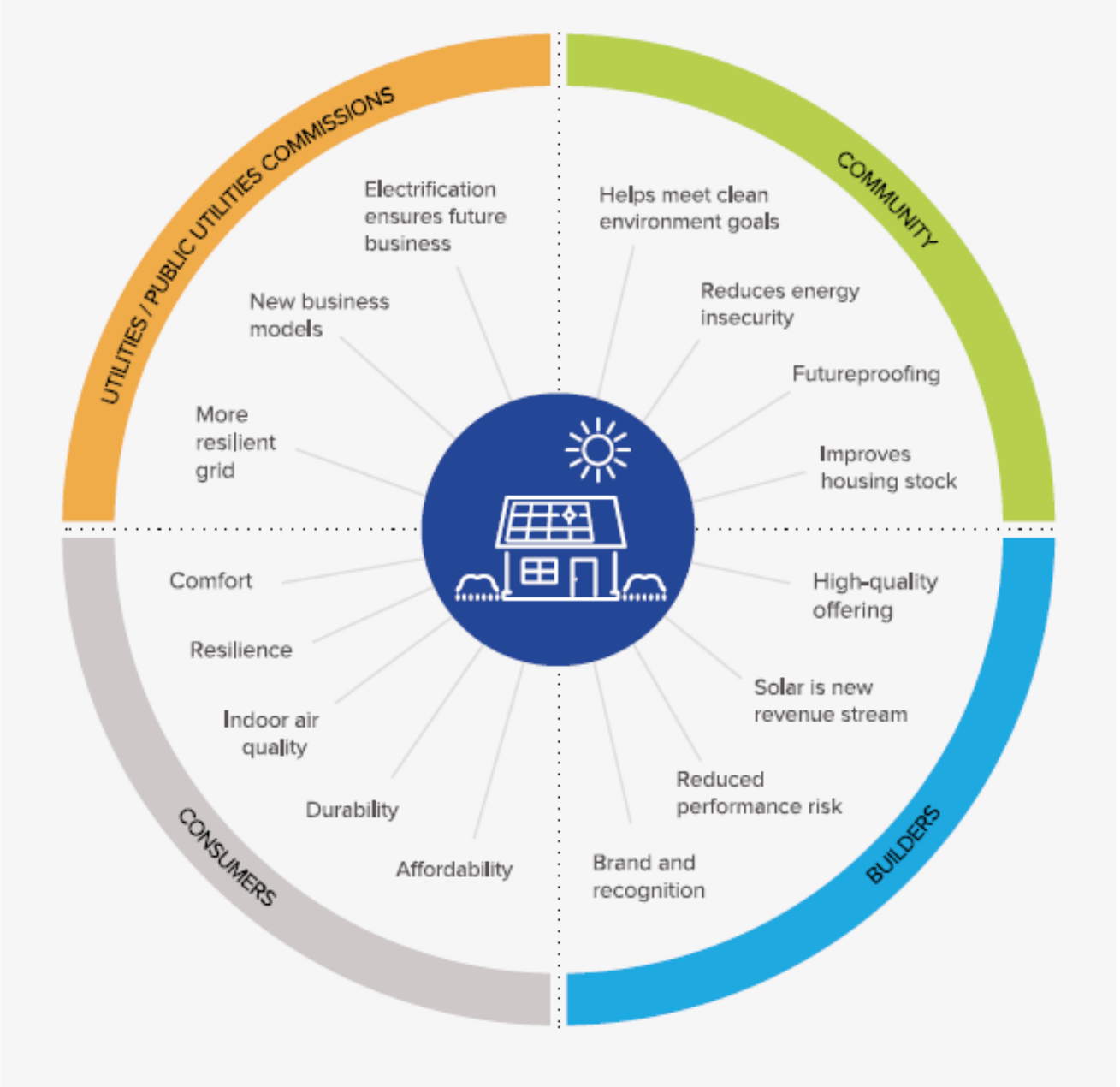


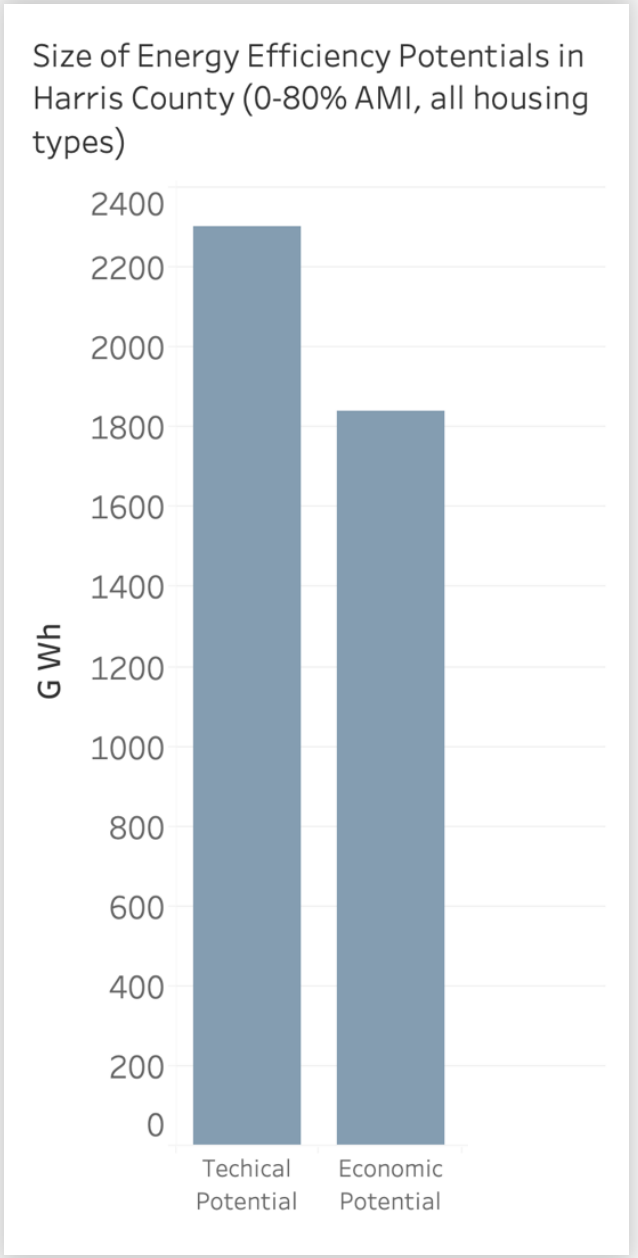
Image Source: *The Economics of Zero-Energy Homes Single-Family Insights*, Rocky Mountain Institute

ENERGY EFFICIENCY POTENTIAL

Low-income households have high energy efficiency potential because of lower quality of building stock, appliances, and lighting

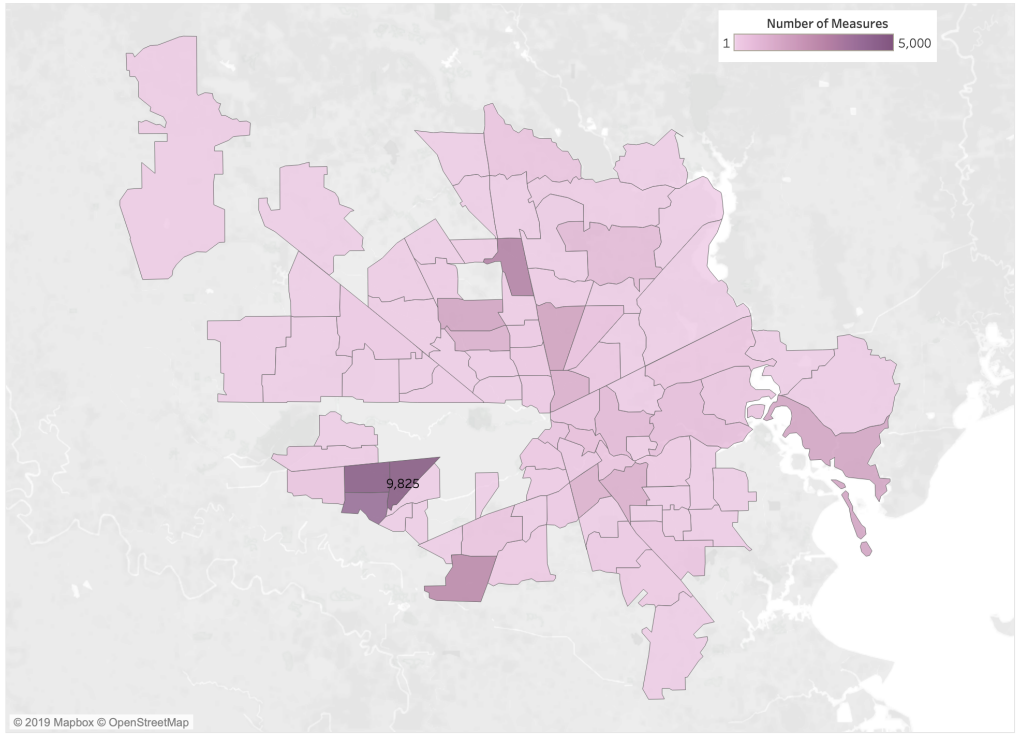
EE Potential	GWh	Reduction in EAG
Technical	2,301	$252,879,900
Economic	1,841	$202,325,900

Potential - technical and economic - of energy efficiency measures for low-income housing units in Harris County

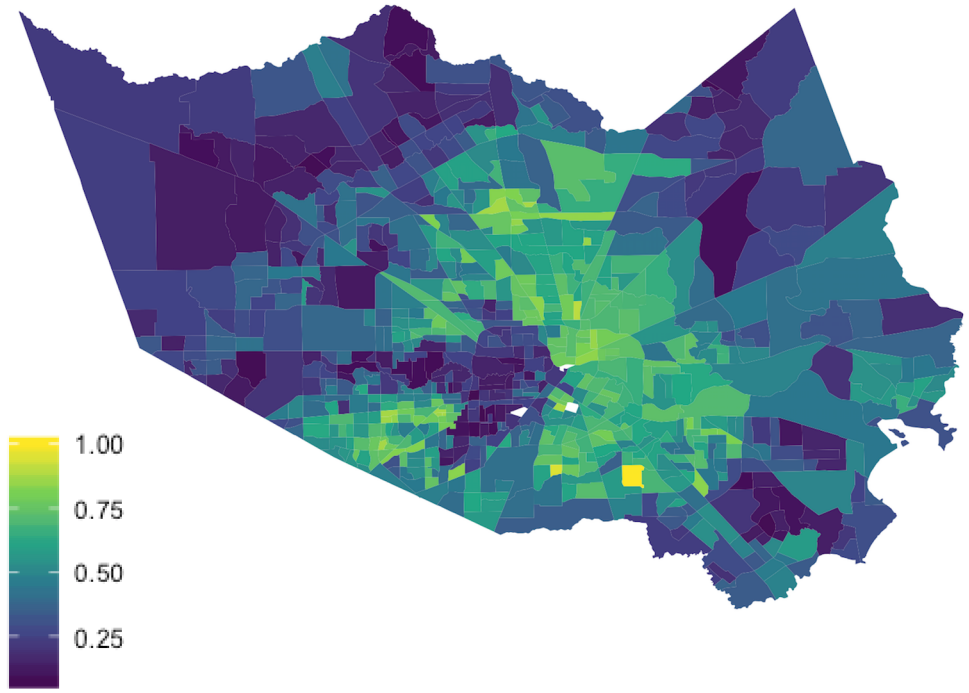


REACHING THOSE MOST IN-NEED

Comparing energy efficiency implementations by location (CenterPoint Energy) relative to census tracts with high percentage of low-income households for Harris County



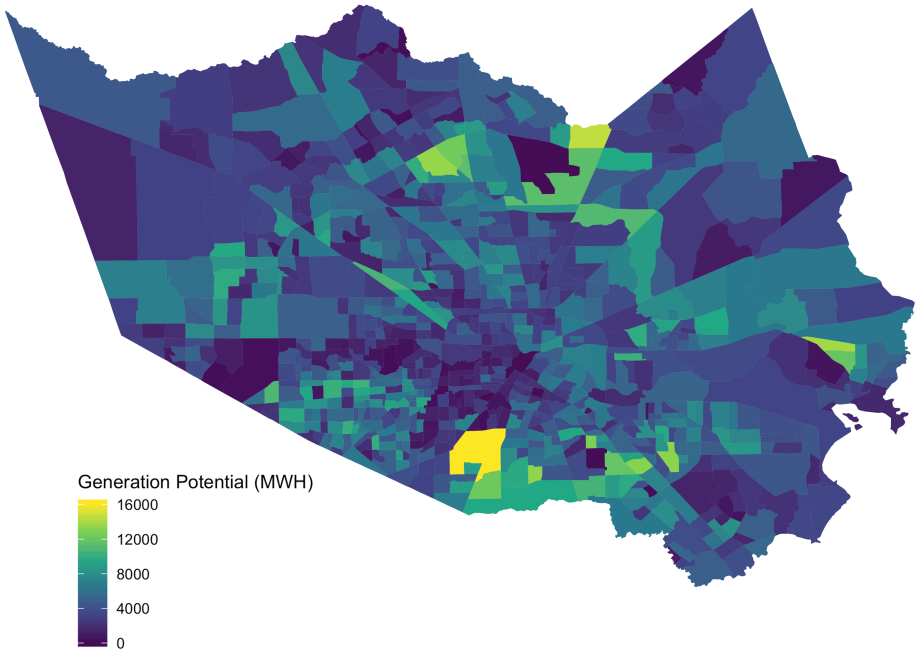
Summary of CenterPoint Energy Efficiency implementations of hard-to-reach customers (2015-19) by zip code

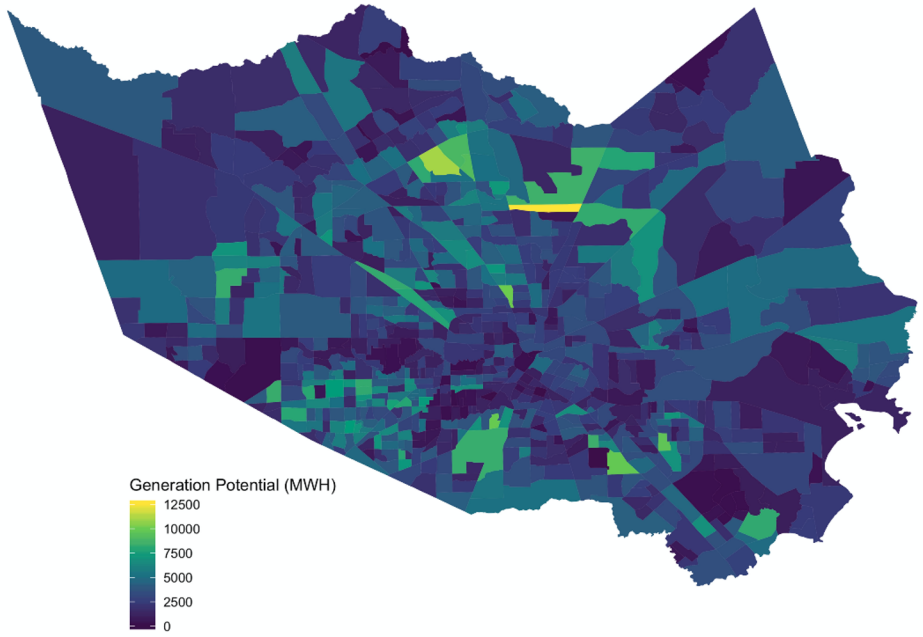


Portion of Households that are 0-80% AMI for Harris County of all households, by census tract (LEAD Tool)

ROOFTOP SOLAR POTENTIAL

Technical potential of rooftop solar for single-family homes (left) and multi-family buildings (right) among low-income housing units in Harris County



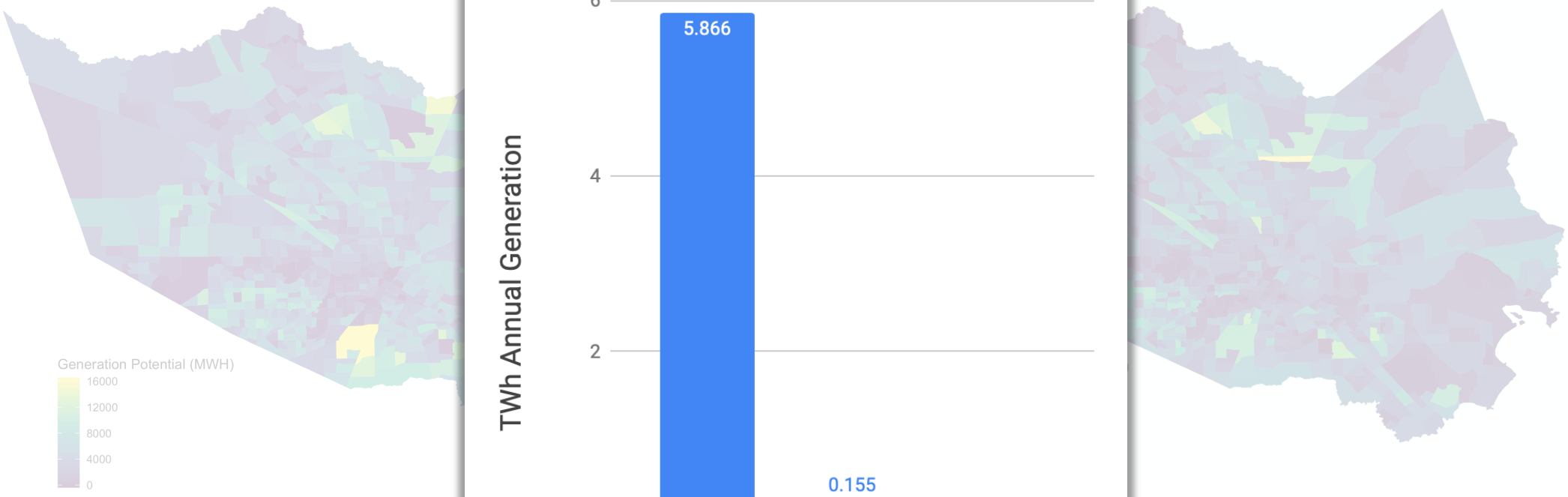


Single-family Homes: Rooftop solar generation technical potential for low-income housing units by census tract, Harris County (NREL)

Multi-Family Buildings: Rooftop solar generation technical potential for low-income housing unit rooftop by census tract, Harris County (NREL)

ROOFTOP SOLAR POTENTIAL

Technical potential of rooftop solar f… gs (right) among low-income housing units in Harris Co…



Single-family Homes: Rooftop solar gener… …ooftop solar generation technical potential for low-income housing units by census tract, Harris County (NREL)

low-income housing unit rooftop by census tract, Harris County (NREL)

ECONOMIC POTENTIAL OF SOLAR

While rooftop solar has great technical potential for single-family homes, the economics are not quite there. However, community solar projects (such as Sunnyside) have potential that could be tapped into now.

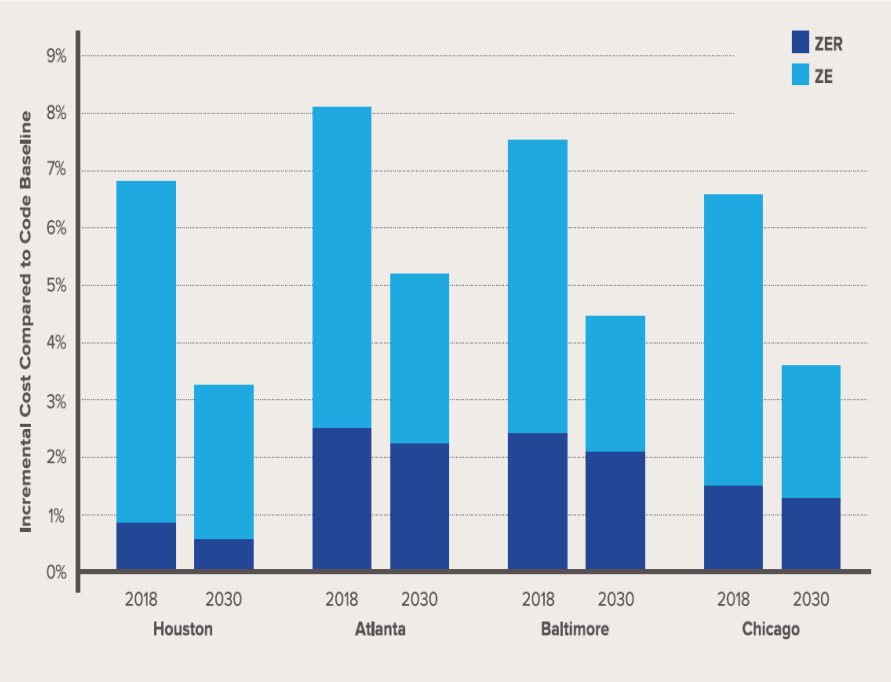
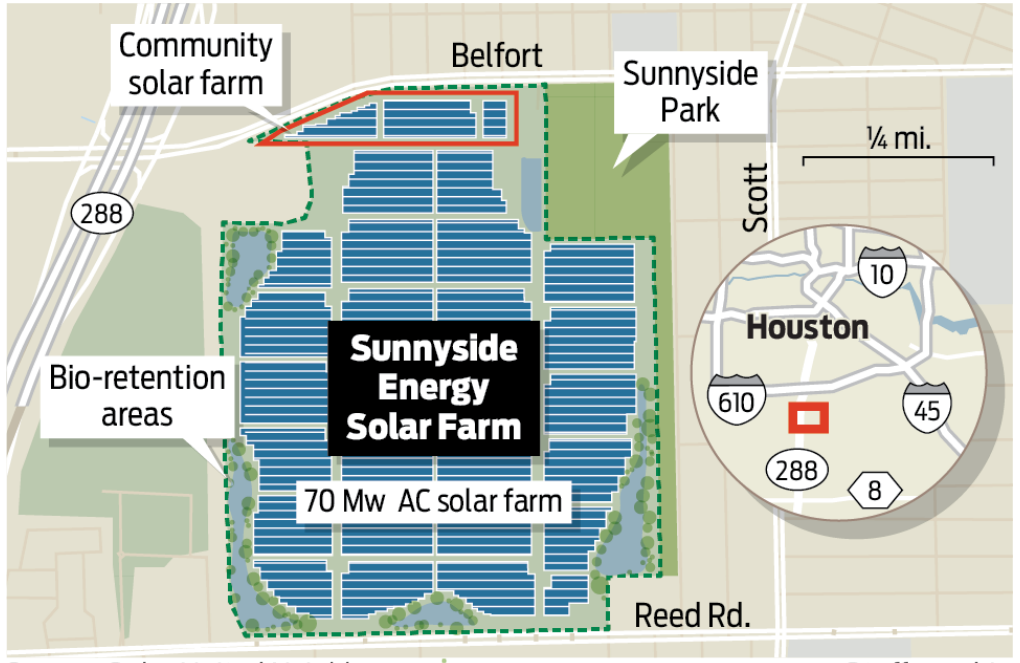


Image Source: *The Economics of Zero-Energy Homes Single-Family Insights*, Rocky Mountain Institute



Source: Solar United Neighbors

Staff graphic

KEY FINDINGS

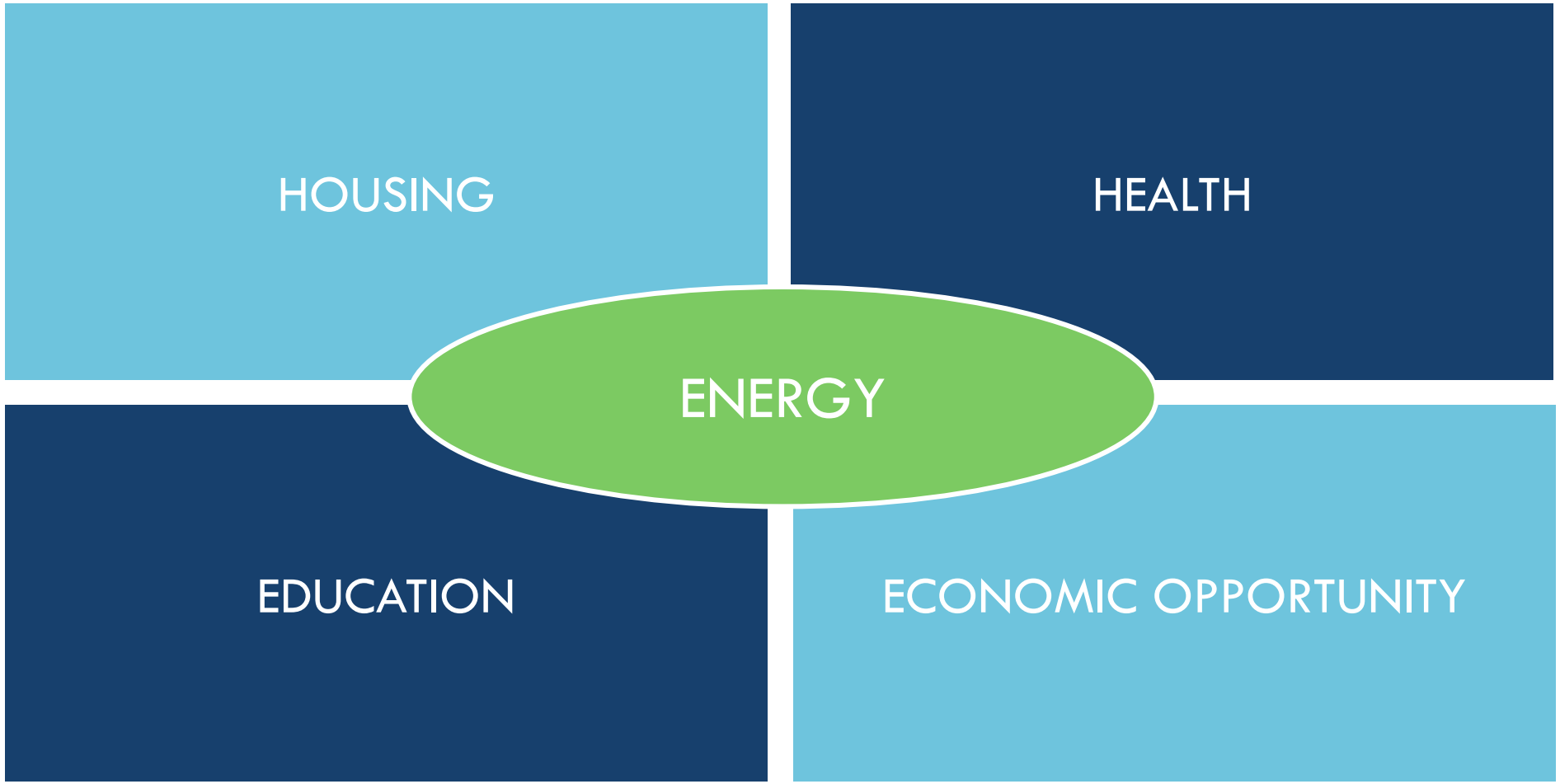
- Energy Efficiency has the potential to economically save 1.8 TWh/ year, which could eliminate the EAG of 1.7 TWh / year
- Solar has the technical potential to produce 5.1 TWh/ year but only economically produce trivial amounts for low-income households
- Community solar has potential to make solar more affordable to low-income households with projects like Sunnyside being prime examples

RECOMMENDATIONS

- Target the existing energy efficiency programs at single family homes in geographical areas with high concentrations of low-income households
- Implement shallow retrofits that are relatively cheap like LED upgrades in as many areas as possible
- We encourage the development of community relations to improve the implementation of weatherization programs in low-income communities

APPENDIX

Holistic approach: How can energy promote ***self-sufficiency***.



Our Work

RESEARCH & EVALUATION

Advance collective knowledge about low-income consumers and their relationships to energy.

DECISION TOOLS

Develop tools to stakeholders make more informed decisions about serving energy needs.

STAKEHOLDER FORUMS

Connect professional peers from power sector, social services, and housing.

OUTREACH & EDUCATION

Reinvent energy consumer engagement for more effective programs.

Distributed Energy Resources

Electrical generation or storage performed by varieties of small, grid-connected resources

Energy Efficiency

- Weatherization
- Lighting & Appliance upgrades

Solar

- Rooftop solar
- Community solar
- Utility scale solar
- Solar Thermal

Grid Storage

- Electric Vehicals
- Li-ion batteries
- Hydro Storage

Demand Response

- Voluntary energy-demand reduction during weather events
- Fuel switching

Energy Affordability

Low-income Households in Harris County

Home Type	Rent or Own	Household Count	Monthly Energy Expenditures	Annual Energy Expenditures	Energy Burden	Estimated Monthly Energy Consumption (kWh)	Estimated Yearly Energy Consumption (kWh)	Estimated Yearly Cooling Load (kWh)	Estimated Yearly Water and Space Heating Potential (kWh)	Estimated Yearly Appliance Potential (kWh)	Total Cooling Potential (GWh)	Total Heating Potential (GWh)	Total Appliance Potential (GWh)
Multifamily	Own	3,670	$111.00	$1,332.00	14%	1,010	12120	2182	4969	4969	8.0	18.2	18.2
Multifamily	Rent	123,084	$86.00	$1,032.00	10%	783	9396	1691	3852	3852	208.2	474.2	474.2
Single-family	Own	53,877	$162.00	$1,944.00	16%	1,474	17688	3184	7252	7252	171.5	390.7	390.7
Single-family	Rent	35,040	$154.00	$1,848.00	15%	1,401	16812	3026	6893	6893	106.0	241.5	241.5
Multifamily	Own	3,860	$102.00	$1,224.00	5%	928	11136	2004	4566	4566	7.7	17.6	17.6
Multifamily	Rent	116,310	$88.00	$1,056.00	4%	801	9612	1730	3941	3941	201.2	458.4	458.4
Single-family	Own	85,124	$160.00	$1,920.00	7%	1,456	17472	3145	7164	7164	267.7	609.8	609.8
Single-family	Rent	31,352	$157.00	$1,884.00	7%	1,429	17148	3087	7031	7031	96.8	220.4	220.4
Multifamily	Own	2,329	$102.00	$1,224.00	4%	928	11136	2004	4566	4566	4.7	10.6	10.6
Multifamily	Rent	63,865	$91.00	$1,092.00	3%	828	9936	1788	4074	4074	114.2	260.2	260.2
Single-family	Own	67,351	$171.00	$2,052.00	5%	1,556	18672	3361	7656	7656	226.4	515.6	515.6
Single-family	Rent	18,711	$161.00	$1,932.00	4%	1,465	17580	3164	7208	7208	59.2	134.9	134.9

Charted by TEPRI (2019) » Data Source: U.S. Department of Energy, 2019, Low-Income Energy Affordability Data (LEAD) V2, with population data from 2016 5-Year American Community Survey (U.S. Census)

Definitions

Energy Poverty: a household does not have access to essential energy services or it cannot afford the services to maintain a healthy lifestyle

Energy Burden: the percentage of household income that is needed to cover home energy expenses

Energy Affordability Gap: the difference between actual home energy bills and affordable home energy bills for the entire population where affordable energy is ≤6% energy burden

Energy Affordability Gap

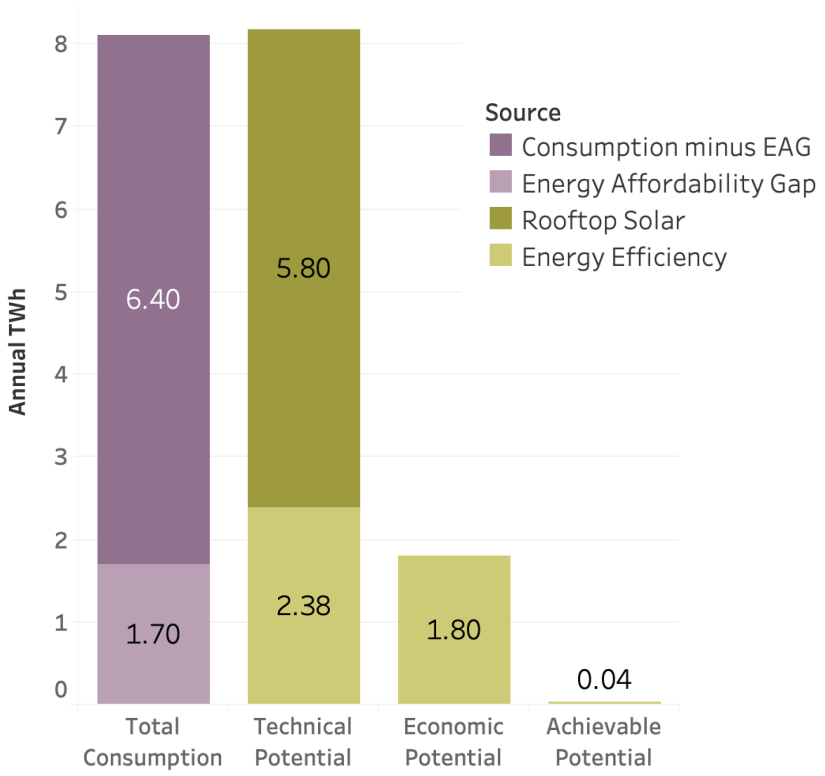
What causes the EAG ,and what has potential to correct it?

TABLE 1. Drivers of household energy burden

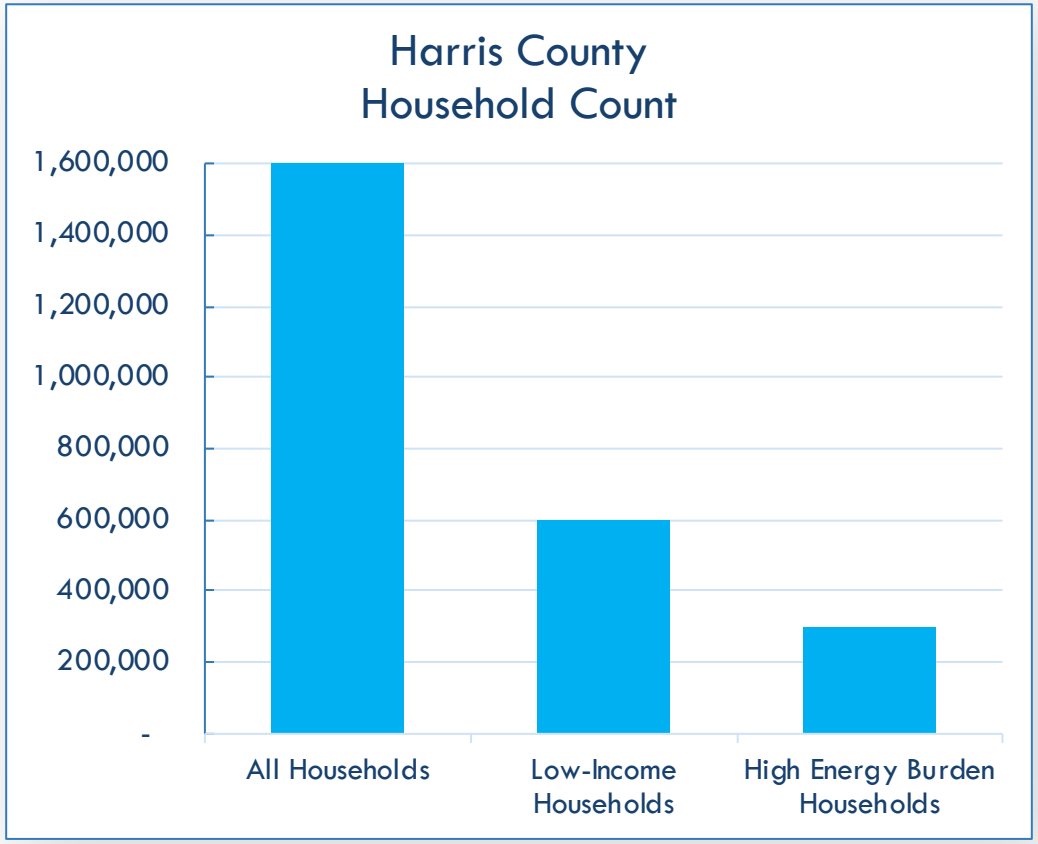
Type of driver	Examples
Physical	Inefficient and/or poorly maintained HVAC systems
	Heating system and fuel type
	Poor insulation, leaky roofs, and inadequate air sealing
	Inefficient large-scale appliances (e.g., refrigerators, dishwashers) and lighting sources
	Weather extremes that raise the need for heating and cooling
Economic	Chronic economic hardship due to persistent low income (see text box "Income Inequality and Energy Affordability")
	Sudden economic hardship (e.g., severe health event or unemployment)
	Inability or difficulty affording the up-front costs of energy efficiency investments
Policy	Insufficient or inaccessible policies and programs for bill assistance, weatherization, and energy efficiency for low-income households
	Certain utility rate design practices, such as high customer fixed charges, that limit the ability of customers to respond to high bills through energy efficiency or conservation
Behavioral	Lack of access to information about bill assistance or energy efficiency programs
	Lack of knowledge about energy conservation measures
	Increased energy use due to age or disability

Chart from: *Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low Income and Underserved Communities,* by Ariel Drehobl and Lauren Ross

Harris County Low-income Energy Consumption, the Energy Affordability Gap, and Potentials for DERs to reduce the Gap



THE ENERGY AFFORDABILITY GAP



Housing Unit Count, Harris County
Source: LEAD Tool

High Energy Burden is >6% of household income

Benefits of Energy Efficient Housing

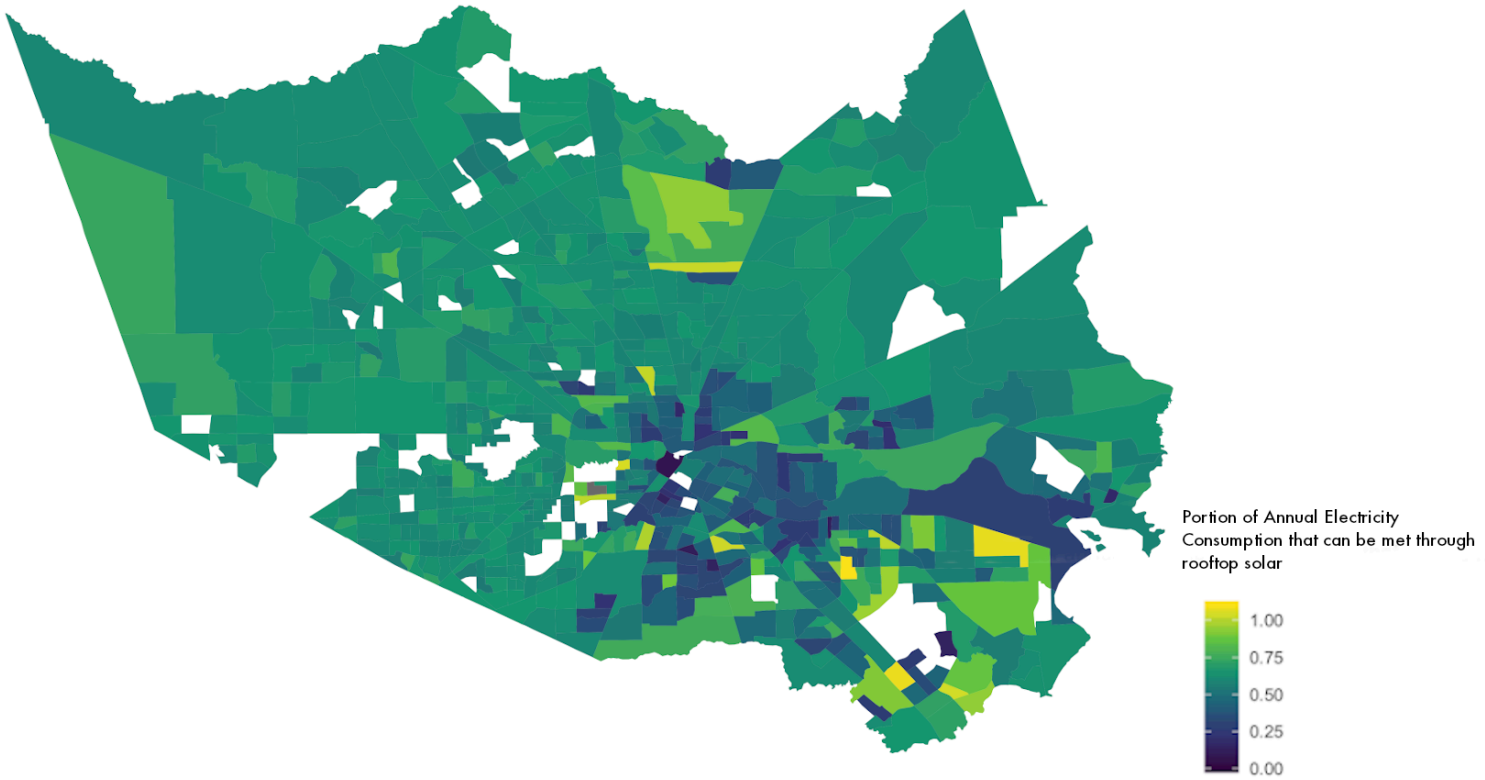
TABLE 7. Energy efficiency benefits for low-income households, utilities, and communities

Benefit recipient	Energy efficiency outcome	Resulting benefit
Low-income program participants	Lower monthly utility bills	Lower household energy burden and greater disposable income
		Reduced stress and fewer trade-offs between energy and other necessities
		Reduced exposure to risk from utility rate increases
	Improvements in the efficiency of the housing stock	Improved health and safety and greater household comfort
		Increased property value, more reliable equipment, and lower maintenance costs
		Greater satisfaction with the building/unit and improved household and neighborhood stability
Utilities and ratepayers	Demand-side management (both gas and electric)	Avoided excess costs of increased generation, capacity, and transmission investments
		Contribution toward compliance with energy efficiency portfolio standards and other environmental legislation
	Cost savings to utilities and ratepayers	Reduced arrearages and cost of shutoffs, which lowers utility operating costs
		Improved customer service
Communities	Lower electric and gas demand	Reduced environmental pollutants and improved public health
	Lower monthly utility bills due to avoided utility costs	More money spent in the local economy due to greater household disposable income, with higher local multiplier effect
		Poverty alleviation and increased standard of living
	Improvements in the efficiency of the housing stock	Local job creation through weatherization programs and energy efficiency providers and trade allies
		Improved quality of life
		Increased property values and preservation of housing stock

Chart from: *Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low Income and Underserved Communities,* by Ariel Drehobl and Lauren Ross

Low-Income Multifamily Solar Potential in Harris County (NREL)

Portion of Low-income multifamily residential energy consumption that can be met by rooftop solar on solar-suitable low-income multifamily buildings in Harris County: Census Tracts with at least 100 low-income multifamily households

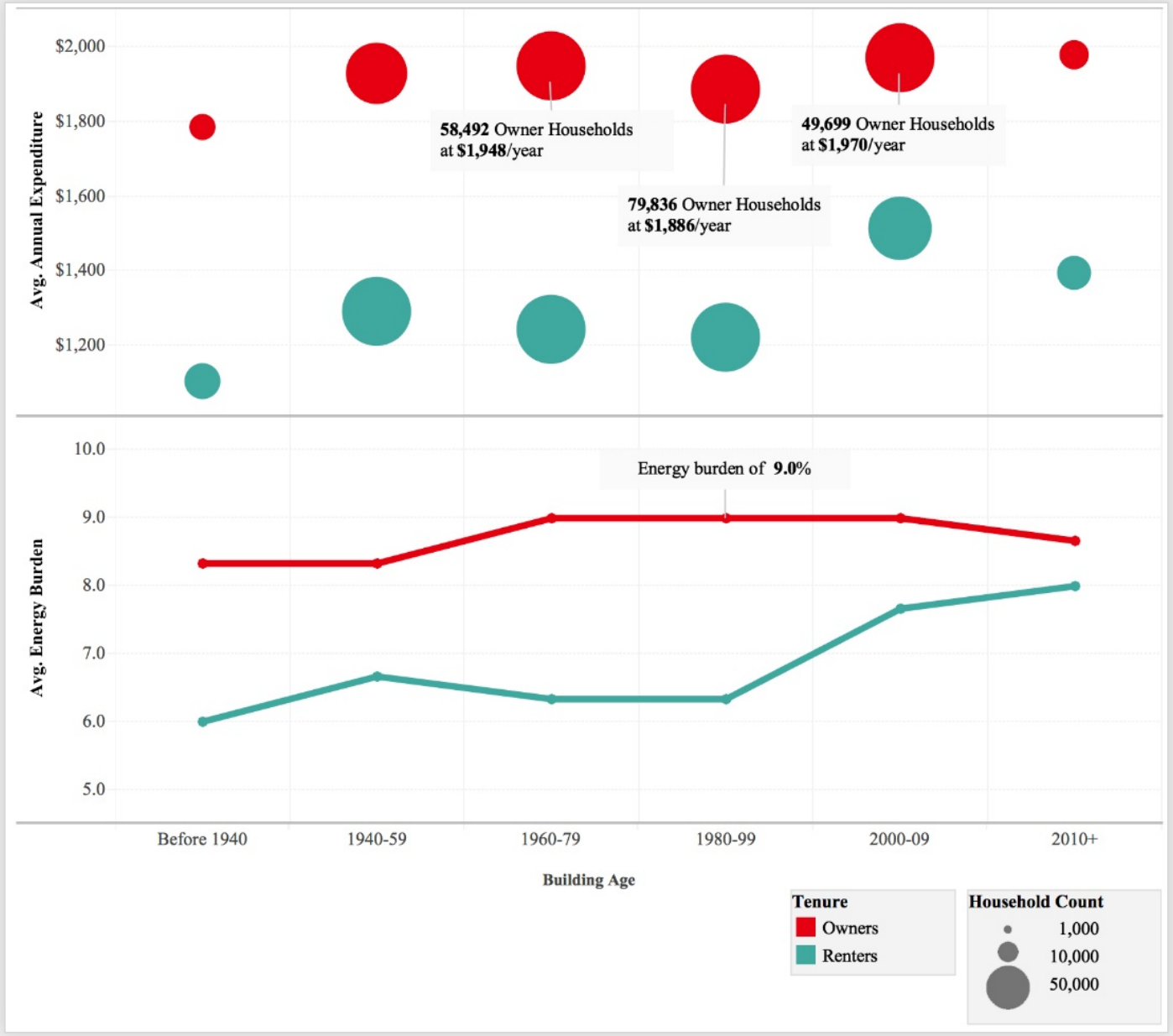


- Total LMI MF Households: 291,014
- Suitable Buildings ~35,000
- Solar Capacity per suitable building: 52 kW
- Average portion of annual energy expenses that can be offset: 58% (all low-income multifamily households)
  - LEAD, overall energy expenses → kWh
- Spoiler: 67% of **all** low-income electricity expenses can be offset if **all** SF and MF households had 100% solar

BUILDING AGE, TENURE

This chart graphs data from the LEAD Tool related to energy costs for low-income households in Harris County by building age (x-axis) and tenure (color of dot).

- *Top*: Average annual energy expenditures
- *Bottom:* Average energy burden



Charted by TEPRI (2020) » **Data Source:** U.S. Department of Energy, 2019, Low-Income Energy Affordability Data (LEAD), with data from the 2016 5-Year American Community Survey (U.S. Census)