A Methodology for Defining Affordability in Commercial Buildings and its Impact on Underserved Communities

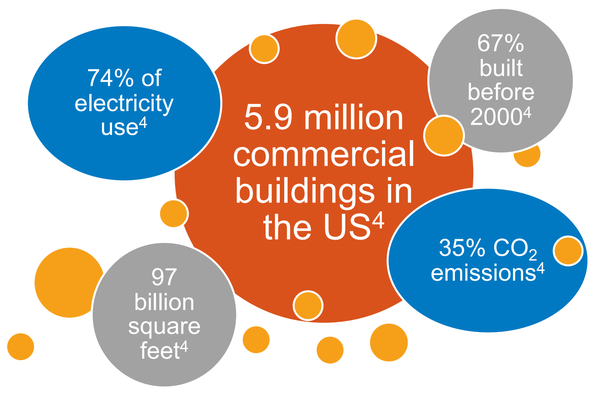
Driving Equitable Access to Energy Efficient, Zero Energy, and Zero Carbon Buildings in Underserved Communities

Principal Investigator: Dr. Ardelia Clarke
PI Email: ardelia.clarke@nrel.gov

Additional Project Contributors: Rois Langner

BACKGROUND / INDUSTRY IMPACT

- Widely identified gap; no definition of affordability in the commercial building sector.
  - Residential Affordable Energy Burden (6%): 30% of the total cost of shelter, 20% of shelter cost for energy[1,2]
- Previous modeling of commercial adoption trends demonstrate energy-efficient heating, cooling, windows, lighting and control solutions… **more likely adopted in newer, larger, more energy-intensive, owner-occupied buildings**… unlikely to diffuse rapidly to rest of commercial building stock.[3]



PROJECT OVERVIEW / OBJECTIVES

Empowering equitable decarbonization in commercial buildings by:

- Developing **an equity, energy, environmental, and climate justice centered** methodology and framework for defining affordability in commercial buildings.
- Mitigating **existing energy inequities and closely associated factors.**
- Increasing local generational wealth building in underserved, disadvantaged communities

APPROACH

- Identify synergic ecosystem between residential economic mobility and commercial buildings (via extensive literature review).
- Produce affordability methodology grounded in **equity, energy, environmental, and climate justice**, **Justice40[5],** and on the barriers/needs of underserved communities.

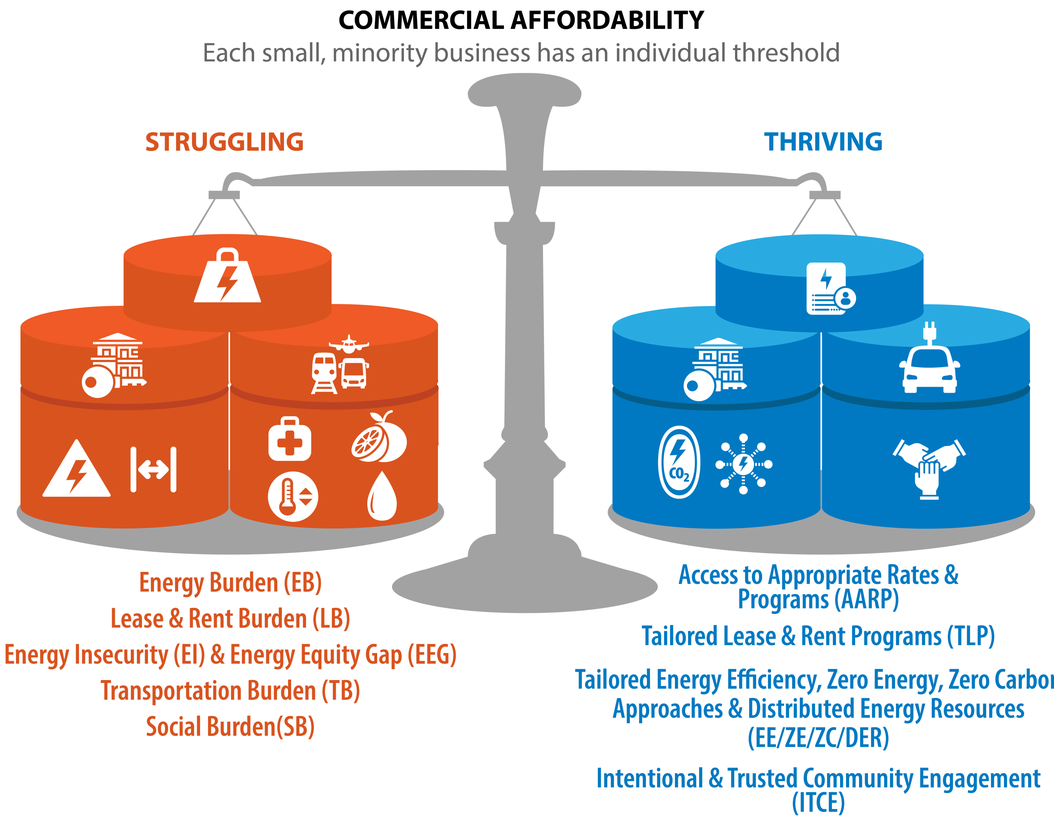
FUTURE WORK

- Publish initial methodology and outward-facing documents.
- Validate and refine initial methodology and framework:
  - Input from community stakeholders.

[1] *Fisher, Sheehan & Colton. 2003. "Home Energy Affordability Gap". http://www.homeenergyaffordabilitygap.com/01_whatIsHEAG2.html*
[2] *ACEEE. 2019. "Understanding Energy Affordability". https://www.aceee.org/sites/default/files/energy-affordability.pdf*
[3] *Andrews, Clinton, Krogman, Uta. 2009. "Explaining the adoption of energy-efficient technologies in U.S. commercial buildings". Energy and Buildings. 41. 3. 287-294. https://www.sciencedirect.com/science/article/pii/S0378778808002156*
[4] *EIA. 2020. https://www.eia.gov/todayinenergy/detail.php?id=46118*
[5] *U.S. DOE Office of Economic Impact and Diversity. 2022. "Justice40 Initiative." https://www.energy.gov/diversity/justice40-initiative*
[6] *Data from U.S. Census Bureau. 2023. "2023 Small Business Revenue Statistics". https://alttine.sobanco.com/small-business-revenue-statistics/ ; https://www.census.gov/programs-surveys/nonemployer-statistics/data/tables.html*

Research Outcomes

- Proposed methodology for defining affordability in commercial buildings
- Demonstrate effect of methodology on commercial buildings and underserved communities via two mapping mechanisms for **equitable decarbonization**
  - ***Struggling***: state of existing inequities in commercial buildings
  - ***Thriving***: current and future building-related solutions to offset inequities



Pictorial representation of the proposed framework for defining affordability in the commercial building sector grounded in an equity, energy, environmental, and climate justice lens to increase equitable decarbonization in commercial building sector.

Impact

- Defining **affordability** in commercial buildings empowers **equitable building decarbonization** by:
  - Reducing energy and non-energy barriers and burdens that impede underserved communities from adopting clean energy commercial technologies and solutions.
  - Designing and optimizing programs that equitably centers solutions tailored to advance decarbonization in underserved, disadvantaged communities.

Examples of Energy Burden for Different Commercial Building Types

Commercial Building Type	Average Monthly Income[6] [$]	Affordable Energy Burden at 6% [$]	Cost-burdened ≧ 30% [$]
Nonemployee Small Businesses	$ 4,124	$ 247.40	$ 1,237
Retail Trade	$ 3,736	$ 224.20	$ 1,120
Accommodation & food services	$ 3,264	$ 195.80	$ 979.2

NREL is a national laboratory of the U. S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

DOE BTO Peer Review
Arlington, VA
April 24- 27th
NREL/PO-5500-86019