



Household Energy Efficiency Analysis for the Hill District, Pennsylvania

Many households in the Hill District, Pennsylvania, could save hundreds of dollars annually on their energy bills and reduce carbon emissions with energy efficiency retrofits and upgrades in their homes and apartments. As part of the U.S. Department of Energy’s (DOE) Communities LEAP (Local Energy Action Program) pilot, the National Renewable Energy Laboratory (NREL) analyzed energy efficiency and electrification upgrades for the Hill District.

Top End-Uses of Energy in the Hill District

Heating is the dominant end use for energy, and natural gas is the dominant fuel type.

Top 4 residential energy uses in the Hill District:

- 50% for space heating using natural gas
- 14% for hot water heating using natural gas
- 8% for space heating using electricity
- 8% for plug loads using electricity

Energy Challenges of Hill District’s Housing Stock

An estimated 88% of the homes and apartments analyzed in the Hill District have poor building envelopes, meaning inadequate insulation and sealing allows air in and out of homes. Inadequate building envelopes increase the cost of heating and cooling homes, which requires residents to spend a higher share of their income on energy. Updating the building envelope could help lower the share of income residents must spend on energy, known as energy burden, and provide a more comfortable and safe indoor environment.

Basic Enclosure Upgrade Average Annual Savings Per Household for 0%–80% Area Median Income (AMI) Community Members

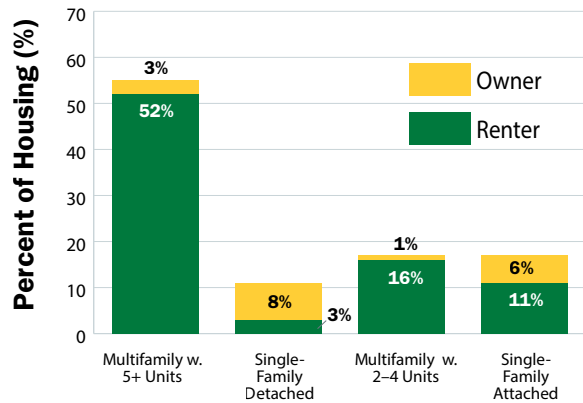
Home Type	Estimated Average Energy Bill Reductions	Impact of Energy Bill Reductions on Energy Burden (pre -> post)	Average Site Energy Reduction (%)
Single-family detached home built before 1940 with masonry construction and renters	\$340	19.5% → 16.5%	26%
Single-family attached home built before 1940 with masonry construction and renters	\$293	20.7% → 17.8%	24%
Multifamily buildings with masonry construction*	\$228	18.3% → 16.0%	18%
All Modeled Dwelling Types (0%–80% AMI)	\$268	18.0% → 15.6%	20%

Actual site energy reductions, energy bill reductions, and changes to energy burden for any individual household will vary.

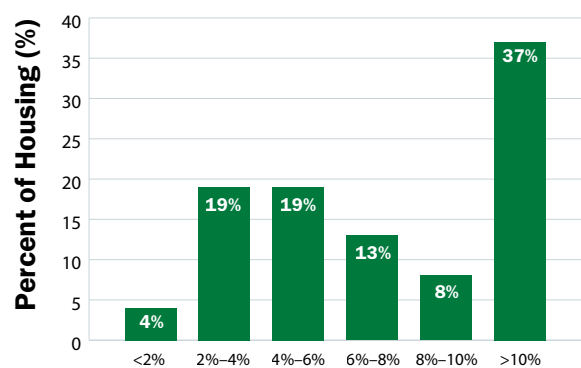
* Results are average annual savings per household (per unit for multifamily buildings); actual savings for any individual household can vary.

Hill District (Pittsburgh), Pennsylvania Residential Housing Stock Summary

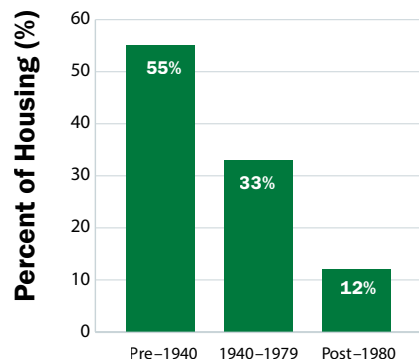
Building Type



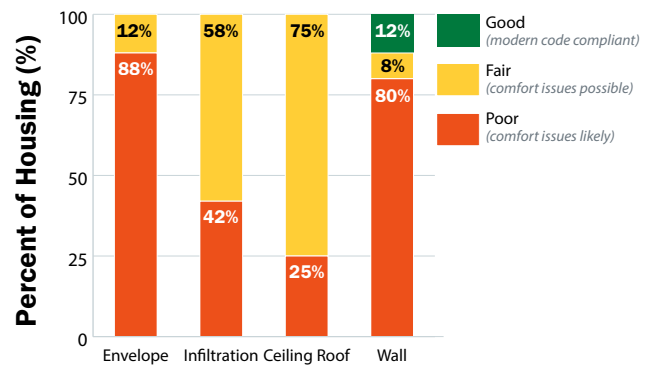
Energy Burden



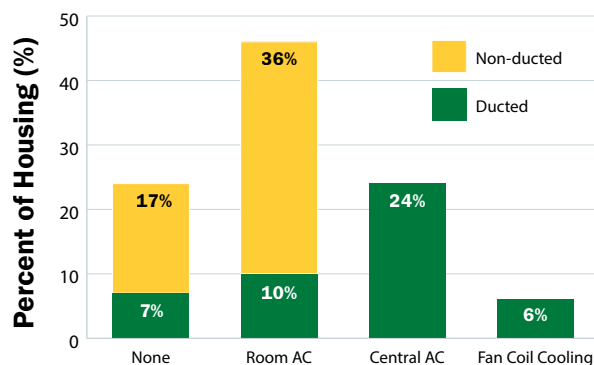
Construction Year



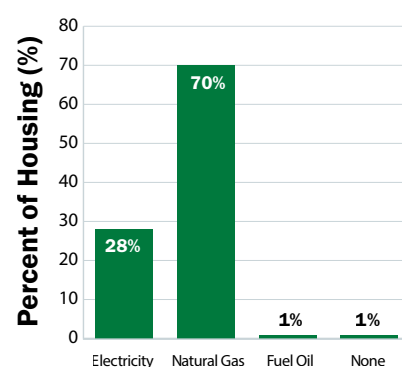
Envelope Status for Buildings with Masonry Wall



Cooling Type



Space Heating Fuel



For more information about the Communities LEAP effort in the Hill District, visit: <https://www.energy.gov/communitiesLEAP/hill-district-pittsburgh-pennsylvania>

For information on energy efficiency improvements, including smaller do-it-yourself projects, visit DOE's Office of Energy Efficiency and Renewable Energy's Energy Saver webpage: <https://www.energy.gov/energysaver/energy-saver>

Annual Community-Wide Savings by Upgrade

The results below are the estimated average annual savings for all modeled household types located in the Hill District.



Energy Bill Reductions

Million \$



Emissions Reductions

Equivalent to number of cars taken off the road



Energy Savings

Equivalent number of homes



Range of Energy Bill Reductions per Household

In dollars

Basic enclosure*

26

25,500

22,300

\$93 to \$355

Enhanced enclosure**

30

29,200

25,500

\$104 to \$408

Heat pump water heater

3.2

9,090

9,160

\$-20 to \$56

High-efficiency heat pump with electric heat back up

14

43,000

45,400

\$-150 to \$286

* Basic enclosure includes attic floor insulation, general air sealing, duct sealing, duct insulation, and wall insulation.

** Enhanced enclosure includes basic enclosure with insulating foundation walls and rim joists, sealing crawlspace vent, and insulating finished attics and cathedral ceilings.

Basic Enclosure Upgrade

NREL's analysis for the Hill District showed that on average, the most cost-effective option for upgrading energy efficiency is the basic enclosure, which includes adding insulation to exterior walls and the attic, and sealing openings around vents, doors, windows, and crawlspaces. Actual costs will vary depending on many factors, including the price of materials, contractor, size of the project, current incentive programs, and more.

Approach Details

Information on Upgrade Packages

NREL analyzed a total of 16 energy efficiency upgrades for the Hill District. The most cost-effective upgrade was defined as the energy efficiency and retrofit package that resulted in the most energy bill reductions per upgrade cost. All four housing types identified in this fact sheet had the same most cost-effective package.

Modeled energy burden and energy bill reductions vary by ownership (resident-owned or rented), housing type, and other factors. This analysis does not account for federal, state, and local rebates or programs that may further lower energy burden, upgrade costs, and payback periods.

Modeling Assumptions

- Vacant housing was not included as part of this analysis.
- Local equipment, labor costs, and utility costs were taken from a mixture of local and national data sources from 2023 or the most recently available data.
- The envelope status figure was based on 2023 International Energy Conservation Code (IECC) requirements for wall insulation, attic insulation, infiltration rates, and wall construction type.
- Upgrades did not consider new electric panel requirements.
- Electrical panels may need to be upgraded to enable certain energy efficiency and electrification upgrades.



This work presents energy efficiency and electrification modeling results for dwelling units using ResStock EUSS 2022.1, which is a statistical representation based on modeling predictions of energy use and savings, and actual results may vary. Scan the QR code to access the methodology document at <https://www.nrel.gov/docs/fy24osti/88058.pdf>.

To learn more about the modeled packages and upgrades in all building types, please visit <https://data.nrel.gov/submissions/224>.