



## Household Energy Efficiency Analysis for North Birmingham, Alabama

Many households in the community of North Birmingham, Alabama, could reduce their energy bills by hundreds of dollars per year 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 North Birmingham.

For more information about the Communities LEAP effort in North Birmingham visit: <https://www.energy.gov/communitiesLEAP/north-birmingham-alabama>

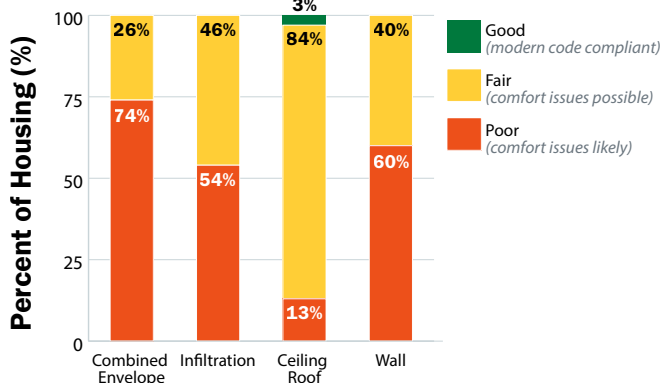
### Top End Uses of Energy in North Birmingham

Space heating is the dominant end-use for energy, and natural gas is the dominant fuel type.

Top 4 residential energy uses in North Birmingham:

- 23% for cooling using electricity
- 22% for heating using natural gas
- 14% for heating using electricity
- 12% for plug loads using electricity

### Envelope Status for Buildings with Frame Wall



Building envelope is the barrier that separates a home’s interior from the exterior. Elements include walls, windows, attic and roof, foundation walls and floors.

## Cost Effective Energy Efficiency Upgrades for North Birmingham Homes

An estimated 74% of the homes and apartments analyzed in North Birmingham 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.

Approximately one in three households in North Birmingham have a high energy burden, which is defined as the share of an individual’s income spent on energy. Updating the building envelope could help lower a resident’s energy burden including increasing insulation in the walls, ceiling and foundation, and sealing air leaks in the home.

### Energy Efficiency Programs and Incentives

**Weatherization Assistance Program:** Local weatherization programs provide low-income households with weatherization projects to reduce energy use and improve home health and safety.

**Neighborhood Housing Services, Healthy Housing Initiative:** Variable funding is available to complete housing rehabilitation (such as roof, electrical and plumbing, structural repairs, etc.), energy-related upgrades, and weatherization repairs and improvements for low-income households in Jefferson County.

**Home Efficiency Rebates\*:** State energy offices (SEO) will provide rebates that discount the price of energy-saving retrofits in homes.

**Home Electrification and Appliance Rebates\*:** SEOs will develop a rebate program that can cover up to 100% of a project’s costs for low-income households.

For more information regarding incentive opportunities for energy efficiency upgrade strategies, visit the North Birmingham Housing Energy Baseline and Upgrade Strategies presentation: <https://www.nrel.gov/docs/fy24osti/89662.pdf>.

Note that a home may only use one of these programs.

\*The final rules for these programs are being developed (as of March 2024).

### Information on Upgrade Packages

NREL analyzed a total of 16 energy efficiency upgrades for North Birmingham to determine the most cost-effective upgrade, providing the most bill reductions. Actual costs will vary based on the cost of materials, contractor, size of the project, current incentive programs, and more. Modeled energy burden and 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.

## Most Cost-Effective Upgrade Strategies for Homes in North Birmingham

Energy Efficiency Upgrade Strategy*	Average Upgrade Cost** (per home)		Average Annual Cost Reductions (per household)		Site Energy Reductions (per home)	
	Natural Gas Heating	Electric Heating	Natural Gas Heating	Electric Heating	Natural Gas Heating	Electric Heating
Basic Enclosure	\$5,900	\$5,900	\$252 - \$655	\$280 - \$880	23%	21%
Enhanced Enclosure	\$8,100	\$7,800	\$297 - \$734	\$324 - \$923	27%	24%
Heat Pump Water Heater (HPWH)	\$2,800	\$2,700	\$99 - \$208	\$60 - \$174	9%	6%
Min. Efficiency Heat Pump w/ Electric Heat Backup	\$14,000	\$15,000	\$209 - \$496	\$265 - \$855	30%	20%

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

\*Upgrade strategy does not include upgrades that may be required to be completed before upgrade, including new electric panel and wiring upgrades.

\*\*The average upgrade cost does not account for current incentive programs. Prices of heat pumps are changing; local costs may differ.

## Modeling Assumptions

This analysis is based on ResStock™ modeled energy consumption. The assumed equipment costs and labor costs were taken from national data sources as of 2023; upgrades did not consider new electric panel requirements. Learn more about the modeled packages and upgrades in all building types at <https://data.nrel.gov/submissions/224>.

### Annual Community-Wide Savings by Upgrade\*\*\*

Energy Efficiency Upgrade Strategy	Emissions Reductions Potential <i>Equivalent to number of cars taken off the road</i>	Energy Bill Reductions <i>Million \$</i>
Basic Enclosure	1,507	2.2
Enhanced Enclosure	1,761	2.6
HPWH	490	0.7
Min. Efficiency Heat Pump w/ Electric Heat Backup	1,697	1.9

\*\*\*Annual reduction potential if all households in North Birmingham received the upgrade

## Housing Energy Efficiency Upgrade Strategies

1. Basic Enclosure Upgrade: this includes upgrading attic insulation to modern building codes; reducing air leakage by 30%; sealing ducts and adding R-8 insulation; and adding drill and fill wall insulation to R-13.
2. Enhanced Enclosure Upgrade: this includes everything in the basic envelope upgrade, as well as adding R-10 insulation to foundation walls and rim joists, sealing crawlspace vents, and insulating the attic and cathedral ceilings to R-30.
3. HPWH: replacing an existing natural gas or electric water heater with a HPWH can provide significant energy savings without sacrificing comfort.
4. Minimum Efficiency Electric Heat Pump with Electric Heat Backup: a minimum efficiency electric heat pump meets minimum code requirements. A heat pump is efficient, can provide heating and cooling, and helps dehumidify the air. When replacing existing gas heating, heat pumps with electric backup also remove the risk of dangerous combustion byproducts that can result from improperly installed or malfunctioning gas furnaces or boilers.

R-Value is the measure of insulation's ability to resist heat traveling through it. Details about R-value for North Birmingham can be found on page 8 of the ResStock Methodology document.



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>.