U.S. Department of ENERGY | Office of State and Community Energy Programs

LEAD Tool Methodology

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Disclaimer

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List of Acronyms

ACS: American Community Survey

ACS5: 5-year American Community Survey data

CEJST: Climate Economic Justice and Screening Tool

DOE: U.S. Department of Energy

EIA: U.S. Energy Information Administration

IPF: Iterative Proportional Fitting

LEAD: Low-income Energy Affordability Data Tool

NREL: National Renewable Energy Laboratory

PUMA: Public Use Microdata Area

PUMS: Public Use Microdata Sample

Table of Contents

List of Figures

List of Tables

1 Introduction

State and local governments, utilities, nonprofits, weatherization providers, and other stakeholders often lack easy access to data to help inform their decision making and have incomplete knowledge of the areas they serve. The Low-income Energy Affordability Data (LEAD) Tool, developed by U.S. Department of Energy (DOE) and National Renewable Energy Laboratory (NREL), helps stakeholders make data-driven decisions on energy goal setting and program planning by providing them information on low-to-moderate-income household populations and associated energy use characteristics.

The LEAD Tool is a web-accessible, interactive platform that allows users to build their own national, state, county, city, or tribal profiles with estimated household and demographic information at various scales. Users can visualize the profiles as well as compare differences among profiles. In addition, users can download visualizations and data.

The LEAD Tool provides interactive maps, charts, and data for housing unit counts; average annual household income; average annual housing electricity, gas, and other fuel expenditures; and average energy burden[1] tabulated by the following categories:

- Geographic level
  - National
  - 50 States plus Washington, D.C., and Puerto Rico
  - County
  - City
  - Census tract
  - Tribal Area.
- Household income level
  - Area Median Income: 0–30%, 30-60%, 60–80%, 80–100%, 100–150%, 150+%
  - Federal Poverty Level: 0–100%, 100–150%, 150–200%, 200–400%, 400+%
  - State Median Income: 0–30%, 30–60%, 60–80%, 80–100%, 100+%.
- Housing unit type

[1] Energy burden is defined as the average annual housing energy costs divided by the average annual household income.

  - Tenure: owner-occupied and renter-occupied
  - Building year of first construction: pre-1940, 1940–1959, 1960–1979, 1980–1999, 2000–2019, and 2020+
  - Number of units in the building: 1-unit detached; 1-unit attached; 2-units; 3- to 4-units; 5- to 9-units; 10- to 19-units; 20 to 49-units; 50- or more units; mobile and trailer; and boat, recreational vehicle, and van
  - Housing unit primary heating fuel type: utility gas, bottled gas, electricity, fuel oil, coal, wood, solar, other, and none.

The Tool also provides additional estimates of household composition based on the following:

- Demographic characteristics
  - Reference person's educational attainment: less than high school, high school, associates or some college, and bachelor's or higher.
  - Race-ethnicity for whole household: white alone Hispanic or Latino, white alone not Hispanic or Latino, black African American alone, American Indian and Alaska Native alone, Asian alone, Native Hawaiian and other Pacific Islander alone, some other race alone, and two or more races.

Finally, the tool provides several visual overlays as guides to users, including:

- Electric retail utility service territory boundaries[2]
  - Territory boundaries can and often do overlap.
- Boundaries for DOE Weatherization Assistance Program (WAP) service providers
  - Service territory boundaries can overlap.
- Locations of WAP training centers
- Disadvantaged Communities.[3]

The LEAD Tool can be used by stakeholders to fill knowledge gaps, conduct strategic energy planning, inform the development of low-income energy programs and goals, improve energy program targeting, and increase public awareness of low-income

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[2] U.S. Energy Information Administration. "U.S. Energy Atlas" https://atlas.eia.gov/datasets/geoplatform::electric-retail-service-territories-2/about

[3] Definitions of disadvantaged communities and the associated census tracts from the Council on Environmental Quality's Climate Economic Justice and Screening Tool (CEJST) https://screeningtool.geoplatform.gov/en/

household issues. However, this tool is not meant to be used as a substitute for evaluating program or policy effectiveness or for tracking year-to-year changes. Since LEAD relies upon survey data of a rolling five-year average and estimation techniques, associated uncertainties and margins of errors render a time series representation of the data based on different LEAD Tool vintages unreliable for analysis purposes.

2 Methodology

The LEAD Tool provides estimates of residential housing energy use including electricity, gas, and other fuels and demographic characteristics of occupants including education attainment of the reference person (formerly called householder) and race-ethnicity. The estimation process starts with the development of housing unit population distributions through the selection of cohorts assumed to have homogeneous energy use characteristics. In the residential housing sector, cohorts are based on locational, occupancy, physical, and household income characteristics of housing units. Energy use values by cohort come from available microdata samples. These energy use values are then rescaled to match aggregate values from electric and natural gas utility reported sales and revenues as well as state-level values for other fuels such as bottled gas and fuel oil. Additional demographic characteristics also come from available microdata samples, but these are rescaled to match the associated tabulated values. Finally, values are calculated at the city, county, and tribal area levels. Cities are matched to those in the State and Local Planning for Energy tool, which are derived from cities with a 2020 census population greater than 20,000 people. The detailed methodology is provided below.

2.1 Distribution of Housing Unit Types

Spatial allocation of different housing unit types relies on the use of an iterative proportional fitting (IPF) algorithm.[4,5] IPF is used sequentially to build increasingly complex cross-tabulations. Census tract-level published tables from the five-year American Community Survey (ACS5)[6] are used as the marginal totals, and cross-tabulations of the ACS5 Public Use Microdata Samples (PUMS)[7] for the corresponding Public Use Microdata Areas (PUMA) are used as the seeds in the IPF algorithm. The resulting cross-tabulations (see Table 1) include housing unit tenure, building year of first construction, number of units in the building, primary heating fuel type, number of persons, and household income. Subsequently, household income and number of persons are collapsed to a single variable using the U.S Department of Housing and Urban Development definition of Area Median Income and U.S. Department of Health

[4] IPF is applied in Lovelace, R. 2014. *Introducing Spatial Microsimulation with R: A Practical*. National Centre for Research Methods Working Paper. http://eprints.ncrm.ac.uk/3348/4/spat_microsimulation_R.pdf.

[5] IPF is also introduced in Pritchard, David R.; and Eric J. Miller. 2012. “Advances in population synthesis: fitting many attributes per agent and fitting to household and person margins simultaneously.” *Transportation 39* (3), 685–704. https://doi.org/10.1002/0471249688

[6] LEAD data vintage is based on the final year of the survey. In other words, the 2022 release of LEAD relies upon the 2018–2022 five-year American Community Survey. See U.S. Census Bureau. 2024. “American Community Survey Data.” https://www.census.gov/programs-surveys/acs/data.html. Accessed Oct. 2, 2024.

[7] U.S. Census Bureau. “Public Use Microdata Sample (PUMS)” https://www.census.gov/programs-surveys/acs/microdata.html. Accessed Oct. 2, 2024.

and Human Services definition of State Median Income, and Federal Poverty Level[8]. Note that the 60%, 100%, and 150% Area Median Income Limits are not published by the ACS and, for the LEAD Tool, are interpolated or extrapolated from the published 50% and 80% values. For the State of Connecticut, federal values are replaced by state values[9]; and for Puerto Rico, Federal Poverty Level is assumed the same as for the continental United States. Finally, the census blocks are aggregated to census tracts and counties based on a simple weighting of Census Block-level occupied housing unit counts from the most recent Decennial Census.[10]

2.2 Household Demographic Characteristic Estimates

Estimates of household demographic characteristics are based on cross-tabulations of person records in the ACS5 PUMS. For each housing unit type, an initial count is made regarding the number of persons by race-ethnicity and the educational attainment of the reference person. These counts are then normalized by the number of housing units of each type. They are then assigned to housing units in the Census-tract level distributions based on the PUMA associated with the Census tract and multiplied by the associated number of housing units. Finally, they are rescaled so that Census-tract level totals match the Census tract-level published table totals. As such, at every geographic scale, the sum of the race-ethnicity variable equates to total population by race-ethnicity, and the sum of the educational attainment variable equates to the total number of occupied housing units by educational attainment of the reference person. In this latter case, while educational attainment is a person record, there is exactly one reference person per occupied housing unit.

[8] LEAD income limits are based on the fiscal year of the data release. In other words, the 2022 release of LEAD uses Fiscal Year 2022 income definitions. See U.S. Department of Housing and Urban Development. “Income Limits.” https://www.huduser.gov/portal/datasets/il.html. U.S. Department of Health and Human Services. “Resource Library.” https://www.acf.hhs.gov/ocs/resource-library?f%5B0%5D=policy_guidance_type%3A622&f%5B1%5D=program%3A264&f%5B2%5D=type%3Apolicy_and_guidance. U.S. Department of Health and Human Services. “Poverty Guidelines.” https://aspe.hhs.gov/topics/poverty-economic-mobility/poverty-guidelines. Accessed Oct. 2, 2024.

[9] Connecticut State Department of Housing. “Combined Income Limits.” https://portal.ct.gov/DOH/DOH/Additional-program-pages/Rent-and-Income-Limits. Accessed Oct. 2, 2024.

[10] U.S. Census Bureau. “Decennial Census of Population and Housing.” https://www.census.gov/decennial-census. Accessed Oct. 2, 2024.

Table 1. Cross-Tabulation of ACS5 Data

Variable	Categories	ACS5 Published Table	ACS5 Microdata Sample
Tenure	Owner-Occupied and Renter-Occupied	Included below[a]	TEN
Building year of first construction	2020 and later, 2000–2019, 1980–1999, 1960–1979, 1940–1959, and 1939 and before	B25036, B25127[b]	YRBLT
Number of units in the building	1 Unit Detached, 1 Unit Attached, 2 Units, 3–4 Units, 5–9 Units, 10–19 Units, 20–49 Units, 50 and More Units, and Mobile and Other Units	B25032, B25124[b], B25127[b]	BLD
Primary heating fuel type	Utility Gas, Bottled Gas, Electricity, Fuel Oil, Wood, Coal, Solar, Other, and None	B25117	HFL
Number of persons	1-Person, 2-Person, 3-Person, 4-Person, 5-Person, 6-Person, 7 or More Persons	B25009, B25124[b]	NP
Household income	0–5K, 5–10K, 10–15K, 15–20K, 20–25K, 25–35K, 35K–50K, 50–75K, 75–100K, 100–150K, 150K and more	B25118	HINCP
Area median income	0–30%, 30–60%, 60–80%, 80–100%, 100–150%, greater than 150%	not available	not available
Federal poverty level	0–100%, 100–150%, 150–200%, 200–400%, greater than 400%	not available	not available
State median income	0–30%, 30–60%, 60–80%, 80–100%, greater than 100%	not available	not available
Race-Ethnicity	White Alone Hispanic or Latino, White Alone Not Hispanic or Latino, Black or African American Alone, American Indian or Alaska Native Alone, Native Hawaiian or Other Pacific Islander Alone, Some Other Race, Two or More Races	B01001A-H	RAC1P, HISP
Educational Attainment[c]	Less than High School, High School, Associates or Some College, Bachelors or Higher	B25013	SCHL

[a] Many of the published tables in the ACS5 are broken out by tenure.

[b] The ACS5 published tables include some cross-tabulations, including building year by number of units and number of persons by number of units. These cross-tabulations are incorporated in the IPF sequence to improve agreement between housing unit estimates and published Census values.

[c] Educational Attainment is based on the designated Reference person, a single person per household who formerly has been called the Householder. This person may or may not have the highest educational attainment across all members of the household.

Some releases of the ACS5 PUMS introduce complications regarding geographic definitions. Census makes major revisions to PUMA boundaries for each Decennial Census. For instance, the 2018–2022 five-year release includes two different sets of PUMAs. Surveyed households in 2018, 2019, 2020, and 2021 are assigned to PUMAs

using the older 2010 geographies, and those surveyed in 2022 are assigned to PUMAs using the newer 2020 geographies. Consequently, tracts may correspond to multiple PUMAs. The first future release with fully consistent geographic definitions will be in 2027 for the 2021–2025 five-year ACS. The last release with fully consistent geographic definitions was in 2022 for the 2016–2020 five-year ACS. Most responses, apart from a handful, present themselves as shown in Figure 5 below.

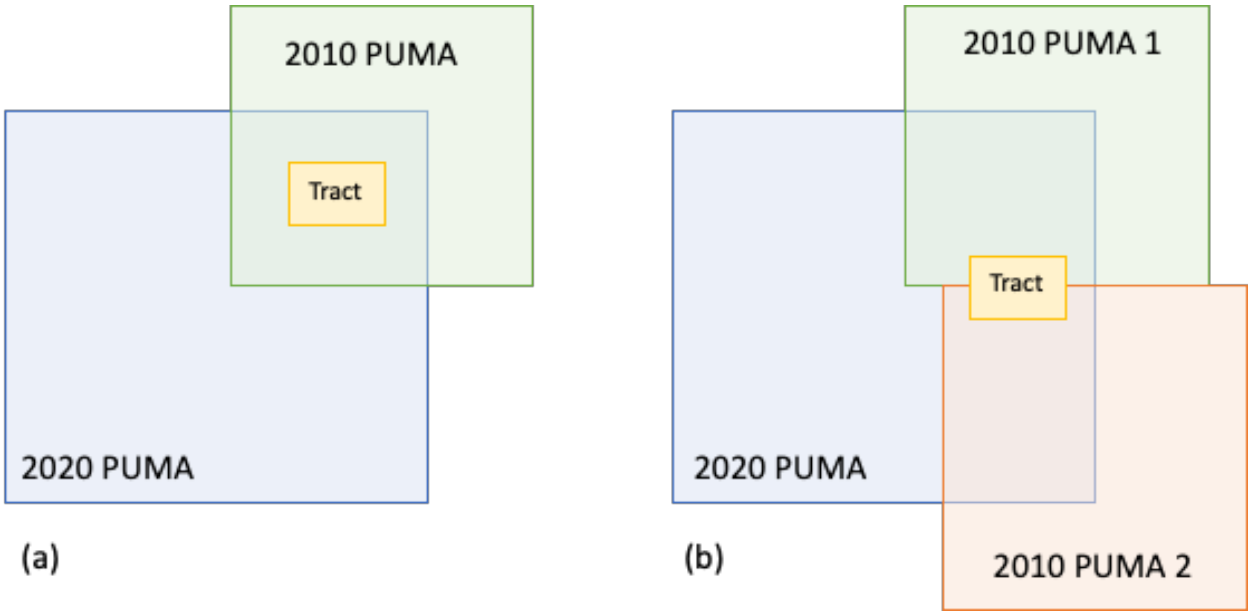

Figure 1. Pictorial representations of ambiguities imposed by inclusion of two different geographical boundaries in the Census American Community Survey Public Use Microdata Samples.

The estimation process relies upon a mapping of Tracts to survey responses. Tracts will always be contained within a PUMA of the same geography vintage, which is 2020 in Figure 5. However, they may be part of one or more prior decennial Census PUMA geographies, which is 2010 in Figure 5. Figure 5a provides an example where a Tract falls within a single 2020 PUMA and a single 2010 PUMA, but the PUMA boundaries do not overlap exactly. Figure 5b provides an example where a Tract is split between two 2010 PUMAs. To develop estimates from a set of survey responses, each response is weighted based on the overlaps shown pictorially in Figure 5. The overlap is calculated simply as the number of occupied housing units in a tract divided by the number of occupied housing units in the PUMA. Those overlaps are based on the block-level occupied housing unit counts in the most recently available Decennial Census Assignment files for the current year PUMAs and the Relationship files for the prior Decennial Census PUMAs.[11]

[11] U.S. Census. “Reference Files.” https://www.census.gov/geographies/reference-files.html. Accessed Oct. 2, 2024.

2.3 Household Energy and Energy Burden Estimates

Estimates of residential energy expenditures are based on cross-tabulations of housing records in the ACS5 PUMS. For each housing unit type, the weighted average household income and expenditures are taken for electricity, gas, and other fuels, separately. The average income and energy expenditures by different housing unit types at the PUMA-level are assigned to the respective housing units at the Census tract level. Energy values are aggregated to electric and natural gas utility service territories for calibration. For other fuels like bottled gas and fuel oil, these are aggregated to the state for calibration. After calibration, the total energy expenditures are divided by household income to calculate household energy burden.

Census ACS5 PUMS variables used in the calculation are provided in Table 2 below. The reported data is in the current dollars of each of the five survey years. Income and housing costs are adjusted for inflation through factors given by Census such that all estimates are in the most recent data year. There are temporal differences between the variables. Electricity and gas are monthly whereas other fuel costs are annual. Household income is for the past 12 months and not restricted to a single calendar year. Nevertheless, all values are assigned to the last year of the Census ACS5 period.

Table 2. ACS5 Variables Used for Energy and Burden Estimates

Variable	Categories	ACS5 Microdata Sample	Flag for Inclusion
Electricity cost	Monthly cost for electricity, $3 to $9,999	ELEP	2, 3
Gas cost	Monthly cost for utility gas and bottled gas, $4 to $9,999	GASP	3, 4
Fuel cost	Yearly cost for fuels not including electricity or gas, $3 to $9999	FULP	2, 3
Household income	Past 12 months of household income, -$59,999 to $99,999,999	B25117	NA
Income inflation adjustment	Adjustment factor for income and earnings dollar amounts	ADJINC	NA
Housing inflation adjustment	Adjustment factor for housing dollar amounts	ADJHSG	NA

There are some data limitations. In the ACS PUMS, electricity and gas expenditures are taken for only a single month and that month is not reported publicly. Given the strong seasonal variation of energy use, extrapolation of annual values from monthly values hinges upon the quality of the sampling to cover all months of the year. This cannot be verified with the public data. Nevertheless, the annual value is calculated by simply multiplying the monthly value by 12. Survey responses are removed for which housing energy costs are included in other housing costs, or where energy costs across multiple fuels type are combined. This may bias the estimates to the extent that the true energy costs of households of the same type differ between those that pay them directly and

those that do not. Furthermore, some households may receive bill assistance. This is not reported and could underestimate the actual cost of energy. However, the data would still reflect actual household expenditures.

3 Calibration of Energy Estimates

Since Census tract energy estimates are based on the more geographically aggregated PUMA-level data and rely on unknown sampling across months, additional steps are taken to improve accuracy. Census tract estimates are rescaled to match revenue data reported to the Energy Information Agency (EIA). Energy company revenues for the residential sector are equated to household energy expenditures. Electric and natural gas utility data are reported at the service territory level by state. Other data, including bottled gas and fuel oil, are reported at the state level. Each energy type is handled differently. For electricity, it is assumed that all tracts are served by a utility company based on the high electrification rate found in the United States. For natural gas, this assumption does not hold, and geographic information system data along with reported heating fuel types are used to allocate natural gas utility customers to Census tracts. For utilities, rescaling occurs at the utility service territory level. For other energy types, not including electricity and natural gas, rescaling occurs at the state level.

3.1 Electricity and Natural Gas

Rescaling factors for electricity and natural gas are based on utility reported revenues and customer counts. The calibration process first assigns customers by utility to Census tracts. Then, the process rescales the Census ACS5 PUMS estimates to match utility data by equating average household expenditures to average utility revenues per customer. Of note, rescaling cannot be accomplished perfectly. The number of utility customers does not correspond to the number of housing units. Multiple households may be billed through a single account, and not all households are served by a utility, particularly for natural gas. Furthermore, an individual Census tract may have multiple utilities as utility boundaries do not fall neatly along Census tract boundaries and utility service territories may overlap.

Assigning utility customers to Census tracts is accomplished by using the IPF algorithm, as described previously. The geospatial overlay of utility boundaries with Census tracts yields the initial guess, with columns corresponding to utilities and rows to Census tracts. The resulting cross-tabulation is then used to calculate estimates at the utility service territory-level. Electricity data comes from EIA survey Form-861[12] and natural gas data from EIA survey Form-176.[13] Utility boundary data is extracted from the Hitachi Energy Velocity Suite.[14]

Each Census tract has an estimate for average per household energy expenditures, discussed in Section 3.3, based on the IPF weighted Census ACS PUMS data. Those

[12] U.S. EIA. “Annual Electric Power Industry Report, Form EIA-861 detailed data files.” https://www.eia.gov/electricity/data/eia861/. Accessed Oct. 2, 2024.
[13] U.S. EIA. “Natural Gas Annual Respondent Query System (EIA-176 Data).” https://www.eia.gov/naturalgas/ngqs. Accessed Oct. 2, 2024.
[14] Hitachi Energy. https://www.hitachienergy.com/us/en/products-and-solutions/energy-portfolio-management/market-intelligence-services/velocity-suite, Accessed Oct. 2, 2024.

household expenditures are then aggregated to the utility service territory weighted by customer counts. Those weighted averages are then compared to utility reported per customer revenue to derive the rescaling factors. For tracts with multiple utilities, an average rescaling factor is used based on each utility's fraction of customers.

The general approach is the same between electricity and natural gas; however, additional steps are taken to separate bottled and utility gas use. The ACS5 provides energy expenditures for three categories of heating fuel types: electricity, gas, and other fuels. Electricity is assumed to always be provided by a utility. However, this assumption does not hold true for gas, which includes both utility-delivered natural gas and various forms of bottled gas. To make separate estimates of utility and bottled gas, a series of assumptions are made. First, it is assumed that housing units reporting natural gas as their primary heating type do not use bottled gas and similarly housing units reporting bottled gas as their primary heating type do not have access to utility-delivered natural gas. Second, it is assumed that households reporting some other primary heating fuel utilize each gas proportional to their overall use as the primary heating fuel type at the Census tract level. With these two assumptions, an initial estimate is made of the average per household consumption of natural gas and bottled gas by Census tract.

Some modification to the utility-reported data is necessary to equate household energy expenditures to utility revenues. Only utilities serving residential customers and providing distribution or delivery services are included. Other types of utilities do not have fixed geographic territories and cannot be reliably mapped. For electric utilities, retail power marketers are aggregated at the state and balancing authority level to estimate the price of unbundled electricity. These prices are used to approximate the total expenditures of customers served by distribution-only utilities. In the Electric Reliability Council of Texas balancing authority area, bundled service providers are replaced with delivery companies. The difference in revenue between bundled service providers and delivery only companies divided by sales is used as an estimate for the price of unbundled electricity service. This price is then used to estimate the total revenues by delivery company.

Natural gas utilities are treated similarly to electric utilities. Here, so-called transported natural gas customers purchase the energy portion of their natural gas bill from different companies than the ones that deliver it. For natural gas calibration data, the reverse process is taken in comparison with electricity. Natural gas companies providing both sales and transported sales are used to estimate delivery costs, under the assumption that the commodity price charged to the two types of customers is the same. This estimated delivery cost is then added to the transported cost to determine total expenditures.

To be discussed further below, rescaling appears to improve the accuracy of the estimates; however, there are challenges with this approach. There are data gaps and inaccuracies in the mapping of utilities to Census tracts, leading to incorrect assignments of customers to utilities and customers to Census tracts. The geospatial data include utilities that are not present in the EIA data and vice versa. In some cases, utilities may have changed names, ownership, or merged with other utilities. Some

utilities may not have reported data to EIA in a given year, despite having reported in other years. Lastly, utility service territories may be large or overlap strongly, and this may mask geographic differences.

3.2 Comparison of Census Data to Utility Reported Data

To check the calibration process, household expenditures are aggregated to the utility service territory, pre-calibration and post-calibration. Those expenditures are then compared with the EIA utility-reported per customer revenue to calculate the relative error, given as follows:

$$\text{relative error} = \frac{\text{estimated value} - \text{reported value}}{\text{reported value}}$$

Below, in Figure 5, is the presentation of the distribution of those errors, normalized by utility customers. The top chart represents electricity, and the bottom chart represents natural gas. The yellow bars represent pre-calibration errors, and the blue bars represent post-calibration errors.

The comparison suggests that the Census ACS PUMS expenditures tend to overestimate household electricity costs and tend to underestimate household natural gas costs. This pattern would reflect sampling that occurs more frequently for warmer months when air conditioning loads raise electricity costs and lack of heating needs lowers natural gas costs. However, making this conclusion is difficult due to multiple confounding factors. The Census ACS reflects only occupied housing units. However, electricity customer counts tend to align better with total housing units, including both occupied and unoccupied units. Nevertheless, setting the consumption of unoccupied units to zero would not fully explain the high Census ACS value for electricity and would make the discrepancy with natural gas even greater. The low Census ACS value for natural gas could reflect poor allocation of utility customers to Census tracts. For instance, utility natural gas could be a secondary home heating fuel. Households not reporting natural gas nor bottled gas as their primary heating fuel type are assigned randomly to fill the remaining balance of natural gas utility customers. This may miss significant natural gas consumers. Furthermore, data gaps, like households not paying bills directly, could introduce unknown biases to the estimates.

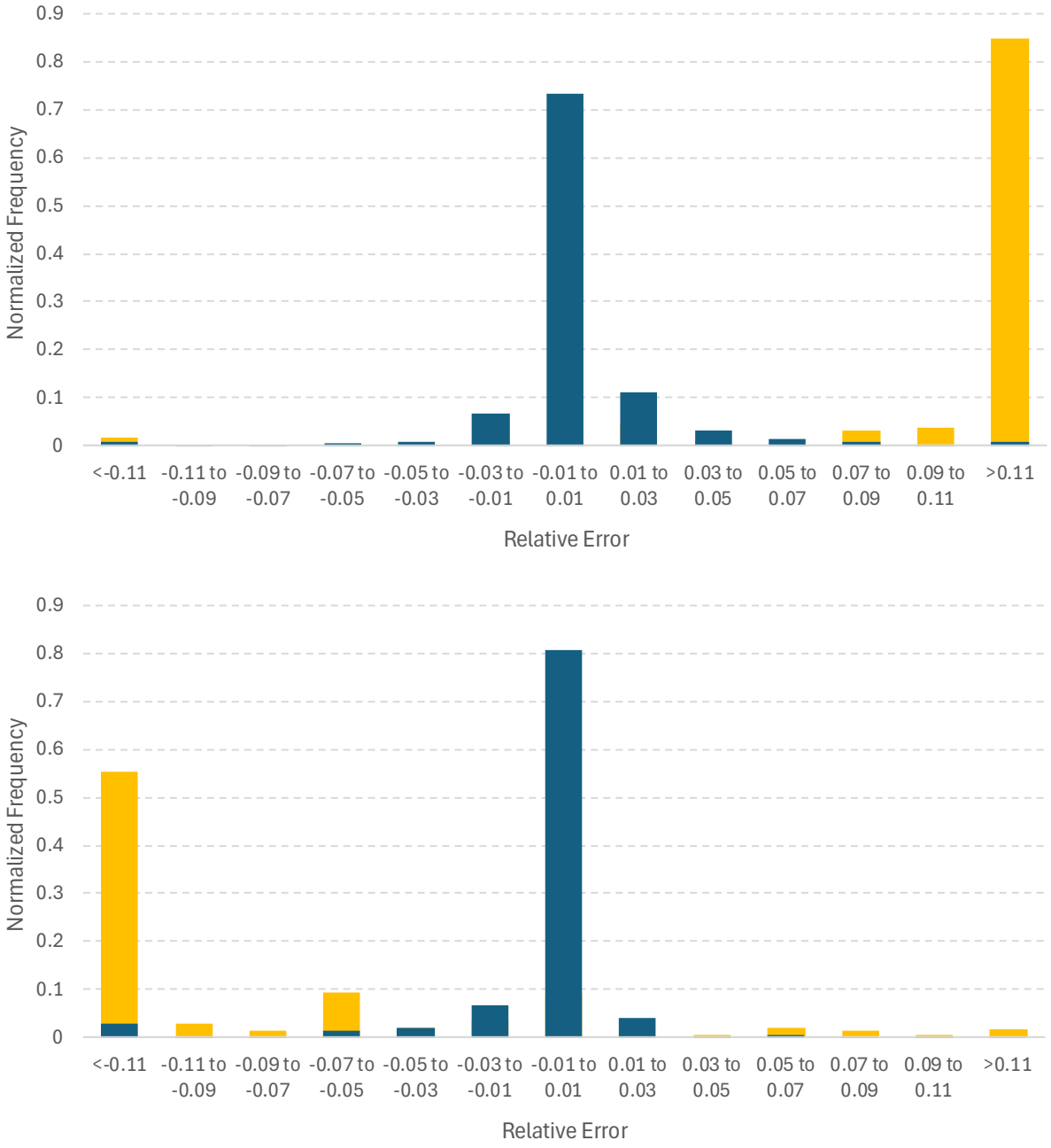

Figure 2. Relative error between estimates for electricity (top) and natural gas (bottom) with utility data reported to EIA. The orange bars are pre-calibration errors, and the blue bars are post-calibration errors.

Focusing just on the blue bars of Figure 5, the calibration yields relative errors of less than 1% for most utilities. However, the calibration process tends to perform poorly for smaller utilities that contain fractions of Census tracts and have widely varying energy prices with adjacent utilities. As discussed previously, weighted averages are used for overlapping utilities. This introduces errors when those weighted averages are then disaggregated back to the develop the distributions given in Figure 5.

4 Discussion

The Low-income Energy Affordability Data (LEAD) Tool seeks to address current gaps in residential housing energy data. Most energy data are available only at the aggregate level. However, strategic development and implementation of energy programs and policies, such as those targeting low-income populations, require disaggregated information on the specific subpopulations of interest. Even in cases where stakeholders have access to household utility data, there is limited information regarding the characteristics of those households such as income level or housing unit type. Given the absence of measured data, the LEAD Tool employs estimation techniques based on widely available statistical data from the U.S. Census Bureau and the Energy Information Administration. This approach has the advantage of providing uniform coverage across all 50 U.S. states, Washington, D.C., and Puerto Rico.

While the LEAD Tool provides demographic and spatial granularity, due to the nature of the underlying statistical data and estimation approach, it does not provide temporal granularity. The ACS data comes from a five-year rolling average, which smooths annual changes. Furthermore, the ACS and the estimation approach result in uncertainties and margins of error. While these have not been calculated explicitly, it is expected for them to exceed any apparent differences from one LEAD Tool vintage to the next.

The web-based LEAD Tool allows users to quickly and easily develop residential housing energy profiles. These profiles provide them information such as:

- How the need for weatherization and/or low-income energy assistance differs across geographies based on the prevalence of those households and the relative magnitudes of their average energy burdens
- How the housing stock differs among low-, moderate-, and high-income households and the relative need for different types of energy efficiency strategies
- How changes to retail energy costs could differentially impact the energy burdens of low-, moderate-, and high-income households
- How energy bill savings, through various energy efficiency programs, could impact energy burden for low-income households, and
- How those with high electricity energy bills can be potential participants for renewable energy, given favorable economics.

Lastly, there may be opportunities to supplement measured data with the LEAD Tool, to fill informational gaps and improve calibration of estimates. For instance, WAP, Low Income Home Energy Assistance Program providers, and the state agencies that oversee those programs may have access to information on applicants and

participants.[15] These data points, while representing measured data rather than estimates, are not statistical samples; and conclusions based on those data points may have unknown biases. Putting those data points in the context of the full low-income household populations from the LEAD Tool may reveal gaps in program coverage or design.

[15] North Carolina Clean Energy Technology Center and Upper Coastal Plain Council of Governments. (2019). “Powering Energy Efficiency and Impacts: A Data-Driven Project Supporting Low-Income Households in Northeastern North Carolina.” https://www.energy.gov/eere/analysis/powering-energy-efficiency-and-impacts-project-framework-peeif.

5 Definitions

Census blocks are the smallest geographic areas used by the U.S. Census Bureau and are bounded by visible features, such as streets, roads, streams, and railroad tracks. Census blocks nest within all other census geographic entities including cities, townships, and counties.

Census tracts are small, statistical subdivisions of a county or a county equivalent. They generally have a population size between 1,200 and 8,000 people, with an average size of 4,000 people.

Minor civil divisions are the primary governmental and/or administrative divisions of a county and include townships and towns. In many states, minor civil divisions can serve as general-purpose governments.

For more information, visit: energy.gov/SCEP

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