Investigating Equity in Energy Code Compliance

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ABSTRACT

For years, residential energy code field studies funded by the U.S. Department of Energy (DOE), states, and utilities, have provided a consistent and statistically valid field sampling approach to measuring energy code compliance, and they have, consequently, identified gaps that contribute to excess energy usage in the new housing stock. The results of these studies have been used to identify opportunities to develop and deploy new trainings for building officials and other industry professionals, and to expand the range and type of resources available. An issue that these residential field studies have historically not addressed, however, is whether there are differences in building code compliance that correlate with income, race, and other sociodemographic characteristics. By using a combination of past field study results and qualitative data, this paper will examine questions of differential compliance, including: 1) how does code compliance differ by jurisdiction, 2) to what extent are jurisdictional differences evident both at a household and a component level, and 3) what geographic, sociodemographic, or other contextual issues are correlated with rates of noncompliance (e.g., race, income, urban vs. rural, etc.). The results shed light on how inconsistent energy code compliance is impacting different communities on opportunities for building energy codes advancement and improving compliance in those communities, and the non-energy implications of noncompliance (e.g., health, safety, affordability).

Introduction

The efficiency of homes is a primary determinant of energy and housing affordability, as well as a key factor influencing a range of social determinants of health, from respiratory outcomes to long-term financial stability (Hernández 2016). Building energy codes provide the minimum acceptable standard for new construction, establishing a baseline of safety, durability, and efficiency that continues to influence housing for decades after construction (Tyler et al. 2023).

Building energy codes have become more stringent over time, with DOE estimating that since 1975 when the first energy codes were developed, model codes have increased in efficiency by approximately 50% by requiring more efficient building approaches and technologies over time (DOE, 2024). Code improvements have driven significant long-term cost and energy savings for homes built to newer energy codes (Tyler et al. 2023).

While a variety of codes of varying levels of efficiency have been adopted across the United States, inconsistent implementation of these codes at a local level can be a barrier to ensuring that homes are built even to the applicable minimum standard. Building energy codes are typically adopted at the state level and enforced at the local level. Implementation at the local level remains crucial to ensuring that new homes are built even to the minimum standards of adopted codes.

Numerous studies show that compliance and enforcement for housing codes, in both new and existing buildings, vary substantially across communities and are often correlated with local sociodemographic characteristics such as race and income. Lemire et al. (2022) find that neighborhoods with the lowest proportion of white residents in Boston, Massachusetts experienced 17% longer wait times before code non-compliance cases for existing buildings were resolved, were 14% more likely to have cases considered overdue, and were 54.4% less likely to result in a repair than neighborhoods with the highest proportion of white residents in the city. In Chicago, Bartram (2022) finds that there are more housing code violations flagged by inspectors in communities of color than in predominately white communities, which is linked to disparities in access to quality housing. Additionally, Bartram (2019) finds that resolved code violations tend to drive up rents but have little impact on residential home prices, while unresolved code violations decrease home prices but have little impact on rent. The result, Bartram concludes, is that codes widen the gap between rich and poor homeowners and reduce affordable housing choices for renters. In New York City, researchers find that code enforcement for existing buildings varies by neighborhood, with low-income neighborhoods generally experiencing the least code enforcement (Andre 2008). Focusing on Memphis, Tennessee, Stacy, Schilling, and Barlow (2018) find that code enforcement is not concentrated in neighborhoods with the highest likelihood of substandard housing conditions. Inspections for existing buildings are not strategic, instead being driven by complaints or reports centered on property exterior, or with code enforcement and health departments working with limited coordination or alignment with health risks.

To complement the findings on existing buildings, residential energy code field studies provide a basis to investigate compliance gaps in new construction energy codes as well, though this work generally does not consider the non-energy impacts of these gaps.[1] Residential field studies are conducted at the state level and generally follow a statistically significant methodology developed by DOE. The methodology assesses key as-built energy efficiency measures in new, single-family homes relative to minimum prescriptive energy code requirements. The energy consumption of the as-built home is then compared to the minimum energy code requirements to quantify related potential savings.

The field studies investigated in this paper (South Carolina and Michigan) were conducted in 2022-2023. Earlier studies across 7 states included post-survey targeted interventions and demonstrated that improvements in energy code compliance led directly to measurable reductions in statewide energy use, with several states showing lower energy use intensity (EUI) compared to the baseline. Increased use of high-efficacy lighting and improved insulation installation quality were the major contributors to these energy gains, while tighter building envelopes and performance-tested duct systems revealed additional efficiency opportunities. Following workforce training and outreach efforts in the target states, increased compliance produced more than $8 million in annual energy cost savings. However, the studies also highlighted that over $10.6 million in potential annual savings remain achievable with further compliance improvements. Responding to field study findings with targeted education combined with a standardized, energy-centric methodology can yield significant and quantifiable reductions in residential energy consumption (Blanding et al. 2022).

[1] All residential energy code field studies referenced followed the DOE methodology, However, some, including the Michigan study, were funded from non-DOE sources.

Despite clear code compliance gaps in energy code implementation and enforcement, there has been little work to shed light on how or why code compliance differs in new construction from community to community. One exception is Nambiar et al. (2023), which uses data from Residential Energy Code Field Studies in 15 states to conclude that lower-income counties nationwide have higher levels of noncompliance in new construction than higher-income counties. This relationship holds true at a measure level for all assessed measures except for floor and wall insulation R-value, which were largely compliant across geographies. The most significant differences in compliance levels between communities were in the grade of wall insulation, quantity and quality of ceiling/roof insulation, duct tightness, and envelope tightness – measures that play a key role in determining the overall efficiency and affordability of housing.

If we take seriously the idea that energy codes are health and safety codes, we must consider that inconsistent enforcement of energy codes can create disparities in terms of access to healthy, safe, and affordable housing (Hurley Brinker 2017). By analyzing the equity dimensions into energy code field studies, we aim to better understand how inconsistent energy code compliance impacts different communities, particularly on the basis of race, income, geography, and other key household characteristics.

The purpose of our analyses is to address the following research questions:

- To what extent does code compliance differ by jurisdiction? To what extent are jurisdictional differences evident in levels of code compliance, both at a household and a component level?
- To what extent do geographic, sociodemographic, or other contextual issues correlate with rates of noncompliance (income, race, urban vs. rural etc.)?

Residential Energy Code Field Studies

Since 2014, residential energy code field studies have provided a consistent and statistically valid sampling approach to measuring energy code compliance in homes. A field study is a survey of building practices that aims to compare local code requirements to actual construction methods and technologies (Bartlett et al. 2022). The survey, which is conducted by visiting homes at different stages of construction, aims to highlight missed opportunities for energy savings.

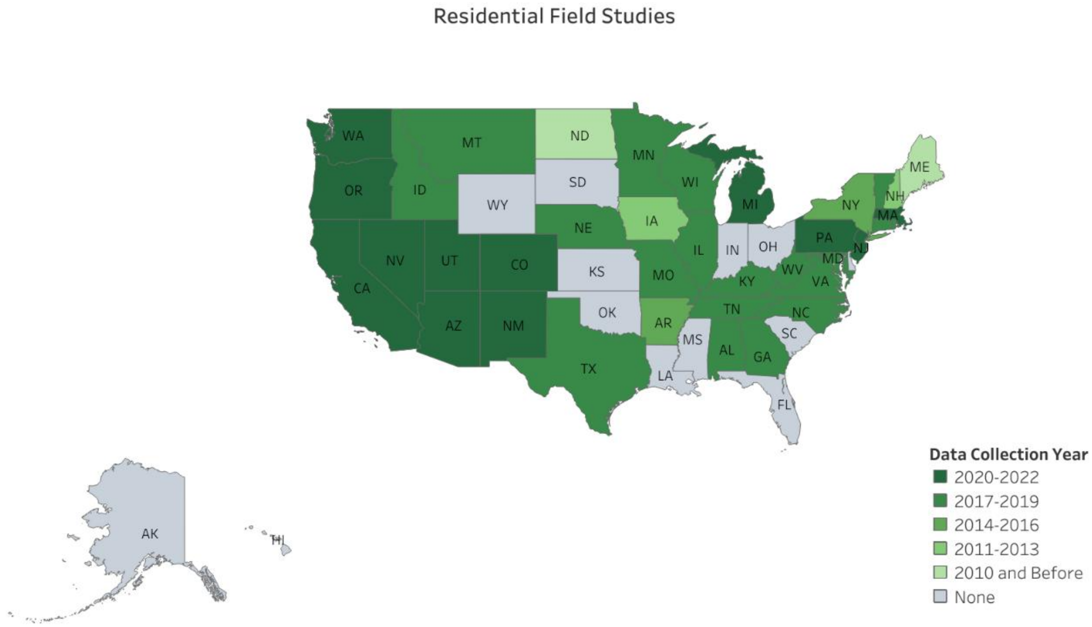

Figure 1. States where residential energy code field studies have been conducted one or more times. States are color-coded, with darker shades indicating more recent data collection. The field study in South Carolina is forthcoming as part of this resource. (U.S. DOE Building Energy Codes Program, 2023)

Field studies are conducted at the state level, and surveyed buildings are chosen using a sampling plan. These plans aim to capture actual measure installations in a statistically valid process that reflects the relative levels of construction activity across the state. This includes noting key items including insulation installation, conducting blower door testing and observing window U-factors; all factors that heavily influence the energy use of a home. DOE has created a uniform methodology for field studies so that results may be comparable across states (Bartlett et al. 2022). As indicated in Figure 1, residential energy code field studies have been carried out in 36 states before 2023, with some states participating in multiple rounds of data collection and analysis (U.S. DOE Building Energy Codes Program, 2023).[2]

To ensure a true representation of compliance, the anonymized survey does not impact construction methods in the surveyed buildings, and noncompliance is not reported to any authority. Once completed, the studies are analyzed to find trends for each key item, potential savings, and statewide energy use estimates. In the DOE framework, including sampling plans, measures of social equity are not applied. DOE and stakeholders like the Regional Energy Efficiency Organizations (REEOs) have used these findings to identify opportunities to advance building energy codes, to develop and deploy new trainings for building officials, and to expand resources for code compliance to close gaps (Blanding et al. 2022).

[2] 19 of the 36 states followed the current DOE methodology with the others following a variety of other methodologies.

Research Methodology

There are two opportunities to consider equity as part of the standard residential energy code field study methodology: in selecting an initial sampling plan to guide data collection, and in analyzing code compliance inconsistencies after data has been collected. The present analysis used data that had been collected in Michigan or South Carolina using a standard method and applied an equity lens on the back end of the analysis.

For the purposes of this analysis, the project team used existing raw data that had been checked for quality assurance from the most recent field studies in Michigan and South Carolina. A comprehensive dataset was developed by merging field observations with U.S. Census Bureau data. To preserve anonymity and enable granular analysis, address-level data was geocoded to census tracts. All numeric field data were analyzed using a binary format (compliant or non-compliant) to compare compliance across specific building measures. When multiple measures were found non-compliant in the same census tract, the values were normalized per home across the tract. Non-compliance is expressed as a percentage for each study item that falls outside the code limits (shown in tables below), over all census tracts per state to enable comparison across jurisdictions.

Measures were selected from the key energy-efficiency items assessed in the field studies. A measure was included if it appeared consistently across both states' samples and if future corrections offered significant savings potential. In some cases, field study raters evaluate a given measure from multiple metrics. For example, not only the R-value of insulation but also its installation quality, assigning grades I, II, or III. Grade I reflects uniform installation with minimal compressions or voids in accordance with manufacturer and industry standards, while Grades II and III are categorized as non-compliant for both walls and ceilings.

For each measure, modeled savings estimates were used to calculate the energy, cost, and emissions reductions that would result if all non-compliant items were brought up to code. Across both states, exterior wall insulation represents the largest savings opportunity, while in South Carolina ceiling insulation contributed more significant savings than in Michigan. Leakage from the envelope of the home is measured with a blower door test, reported in air changes per hour at a standard pressure of 50 pascals (ACH50), and duct leakage within the home is measured in cubic feet per minute (cfm) at 25 pascals (cfm25). Envelope air tightness testing was not required in all jurisdictions sampled in these field studies, but testing was conducted by the data collectors in accordance with the DOE methodology and values used in the compliance assessment and savings potential analyses. Air sealing measures hold greater potential for efficiency savings in Michigan than in South Carolina but are significant for both states. Minimum code required insulation R-values and air sealing levels differ for the two states, due to differences in climatic conditions (energy code climate zones) as well as the state's adopted code level, summarized for both states in Table 1. Additional certain key items such as the percentage of high-efficacy lighting and window U-factors were largely code-compliant across the sampled homes in both states, so were excluded from the analysis.

Table 1. Building Energy Code Requirements for Michigan and South Carolina

State	Code in Effect	Ceiling insulation R-Value/ U-factor (relevant climate zone)	Wall insulation R-value /U-factor	Home envelope (ACH50)	Duct tightness (cfm25)
MI	2015 IECC with amendments[3]	R-38 / U-0.030 (5A) R-49 / U-0.026 (6A, 7)	R-20 or R-13 + 5 ci /U-0.057	4	4
SC	2009[4]	R-30 / U-0.035 (3A)	R-13 / U-0.082	7	12

The project team identified and gathered key data from the U.S. Census Bureau at the census tract level to pair with each measure observation, to facilitate an analysis of how code compliance varies across different socio-economic, demographic, and housing characteristics. This data included:

- The status of each census tract as urban or rural, as measured using Rural-Urban Commuting Area (RUCA) Codes (USDA 2025)[5]
- The proportion of households below the federal poverty level in each census tract in the study in both states in the year of or just before the home construction (U.S. Census Bureau 2022)
- The sale price of each assessed home (various real estate datasets including Realtor.com, Redfin, and Zillow), and an estimate of similar home sales in the same neighborhood
- The proportion of residents in each tract who identify as Black, Indigenous, or People of Color (BIPOC) (U.S. Census Bureau 2022) in the year before or during the field study data collection

Geographic Scope

Michigan and South Carolina are both well-suited for this study, with each state having completed a residential field study within the last three years. Energy codes require specific building standards depending on the climate zone of the home and the edition of the code enforced by the state. Michigan has 3 energy code climate zones as designated by the International Code Council (ICC), while South Carolina spans 2 climate zones. The distribution of the samples in the study covers IECC climate zone 3A for most of South Carolina (N = 127), and zones 5A (N = 116), 6A (N = 13), and 7A (N = 2) for Michigan. The two states also differ in population demographics and economic development indicators, as explained below. By focusing on these states, we can assess code compliance in 5 out of 8 climate zones across the United States. This positions our research to speak to code compliance impacts beyond the focus states.

[3] https://codes.iccsafe.org/content/MIEC2015P1/chapter-1-re-energy-efficiency
[4] https://codes.iccsafe.org/content/IECC2009/chapter-4-residential-energy-efficiency
[5] https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes

Michigan

Michigan is a state with around 10.1 million residents, the majority of whom (83.5%) live in urban counties (Michigan Center for Data and Analytics 2024). While Detroit was once the country's central hub for the automobile industry and the fifth largest city in America, the era of deindustrialization in the 1960s contributed to its transformation into one of the most segregated urban areas in the country (Wilkinson 2016). In 2024, Michigan had a median household income of $72,389, about 12% lower than the national median income of $81,604; this places Michigan in 37th place in a ranking of statewide median incomes (Wilkinson 2025). It is estimated that 13.4% of the population is below the poverty level, while the overall rate for the U.S. is 10.6% (U.S. Census Bureau 2026).

According to Redfin (2026), the average sale price of a Michigan home in February 2026 was $259,900. Michigan has a higher homeownership rate than the country overall: 73% of homes in Michigan are owner-occupied vs 65.3% for the U.S. (US Census Bureau 2024).

At the time of the field study, the state of Michigan had adopted the 2015 IECC with state amendments for residential and commercial buildings. Under state law Michigan is required to update their building energy code every three years for commercial and six years for residential; codes are updated through the state's Department of Licensing and Regulatory Affairs, known as LARA (Michigan Stille-Derossett-Hale Single State Construction Code Act 1972).

The map below sheds light on where in Michigan single-family homes were assessed as part of the most recent field study, at the census tract level, as well as whether these tracts are classified as small town/rural or urban. The median sale price of the new homes constructed in Michigan and sampled for the field study was $451,400, with the highest property value over $4M. For the census tracts that housed the field study properties, the median percentage of persons living in poverty is 4.5%, with a range of 0-30%, along with a median of 7% BIPOC residents (0-70% range). Though there is considerable variability in these indicators, these statistics indicate that new housing is disproportionately being built in economically advantaged geographies with higher than median home values and with lower diversity than surrounding state and national contexts.

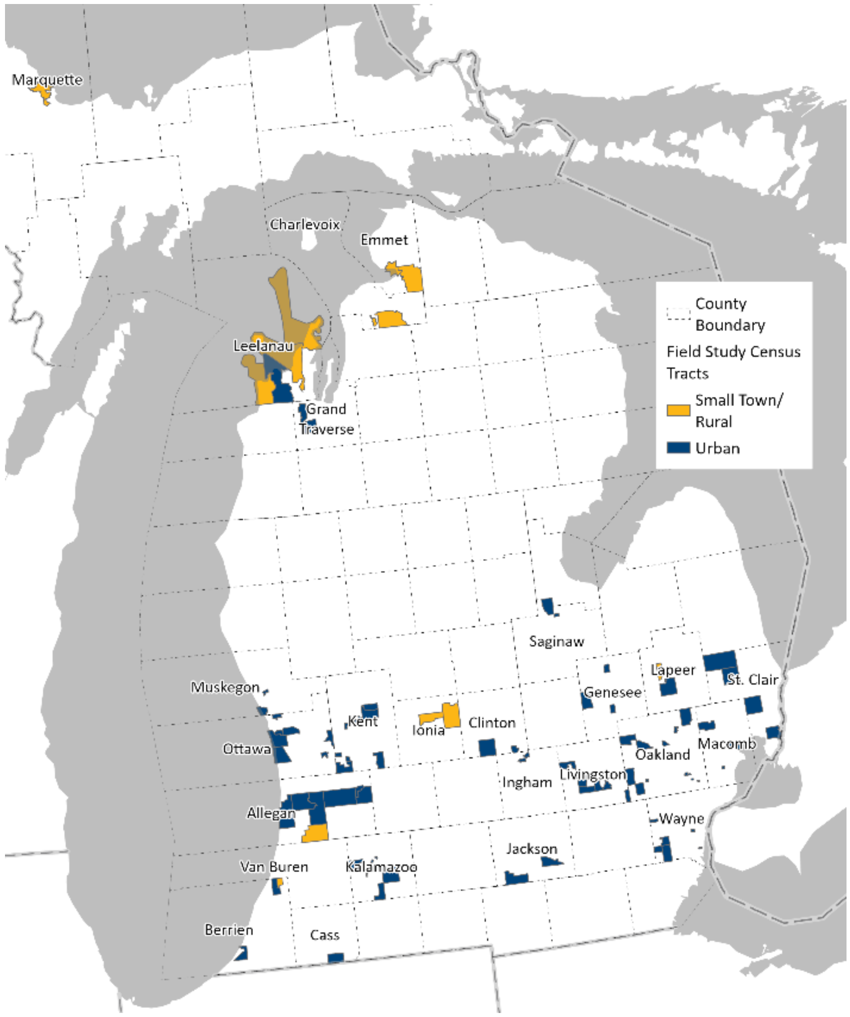

Figure 2. Michigan field study census tracts. Field study geographies are classified as small towns/rural areas (yellow) and urban areas (dark blue) using the USDA's Rural–Urban Commuting Area (RUCA) Codes. Source: U.S. Census Bureau (2022, 2024); U.S. Department of Agriculture (2020).

South Carolina

South Carolina is a Southeastern state with around 5.6 million residents, and a smaller land area that yields a similar population density to that of Michigan. In 2024, South Carolina had a median household income of $69,324, which is significantly lower than the national median, with approximately 13.4% of the population living below the poverty level (US Census Bureau 2024). At the time of the field study, the state of South Carolina had adopted the 2009 IECC Residential Code without amendments.

According to Redfin (2026), the average sale price of a South Carolina home in February 2026 was $376,200. South Carolina also has a higher homeownership rate than the country overall: 72% of homes in South Carolina are owner-occupied (US Census Bureau 2024). South Carolina has similar demographics to national averages in terms of age and gender, with higher racial diversity than the nation as a whole. African Americans comprise 26% of the population, which is nearly twice the average fraction nationwide, and more than two-thirds of the state's BIPOC residents.

The map below sheds light on where in South Carolina single-family homes were assessed as part of the most recent field study, at the census tract level, as well as whether these tracts are classified as small town/rural or urban. The median sale price of the new homes constructed in South Carolina and sampled for the field study was $382,900, with the highest property value about $1.4M. The median sale price of the sample is above, but much closer to, the state median home price than it was for Michigan, perhaps due to a supplement to the sampling methodology to include a few more rural homes, which tend to be lower in cost. For the census tracts that housed the field study properties, the median percentage of persons living in poverty is 6.5%, with a range of 0-46%, along with a median of 24% BIPOC residents (1-95% range). Like in Michigan, but to a lesser degree, these statistics indicate that new housing is typically being built in more economically advantaged geographies with somewhat lower diversity than nation or the local state.

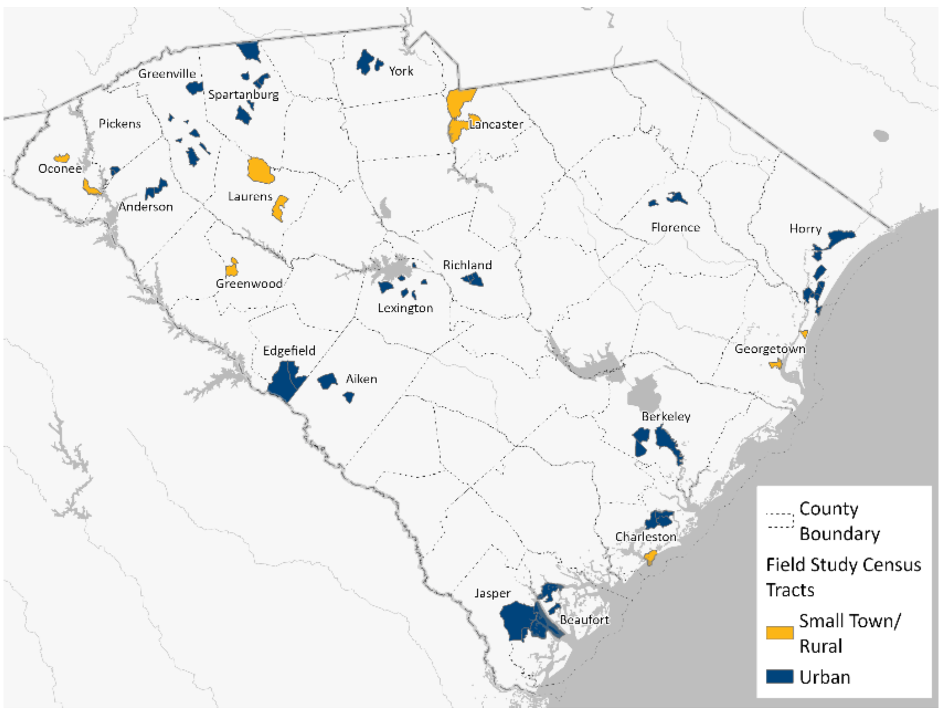

Figure 3. South Carolina field study census tracts. Field study geographies are classified as small towns/rural areas (yellow) and urban areas (dark blue) using the USDA's Rural–Urban Commuting Area (RUCA) Codes. Source: U.S. Census Bureau (2022, 2024); U.S. Department of Agriculture (2020).

Discussion

The existing literature suggests that though code compliance does differ across key social, economic, and housing indicators, our locally-specific analysis found similar rates of compliance for most measures across several key items for a sample of social and economic factors. Table 2 contains the number of homes in the study for each of three economic or social indicators: homes that were initially sold above or below the median sale price, homes that were located in census tracts with poverty levels above or below the state percentage in poverty (13% for both states), and homes that are located in census tracts with populations above or below state median BIPOC percentages (22% for MI and 31% for SC). Table 3 shows the percentage of non-compliance for ceiling insulation, for homes both above-median and below-median values of each indicator in the two states. Table 4 shows the same results as Table 3 for frame wall insulation. The tabulated data show the percentage of homes which are noncompliant for the given measure, separated into below-median or above-median for the given social indicator. For example, in South Carolina, 23% of homes in census tracts that are above the state poverty levels (i.e. lower instances of poverty in the neighborhood) are noncompliant for ceiling insulation quality. On the other hand, 40% of homes in census tracts with poverty levels indicating greater financial constraints are noncompliant for ceiling insulation quality. Home envelope air leakage measures and duct tightness are tabulated in Table 5. Table 6 breaks down the sample by the number of homes located in census tracts in urban metro areas (RUCA codes 1-3) or non-metro rural areas (RUCA codes 4-10). Table 7 presents all of these measures and degree of non-compliance broken down into urban and rural geographies. In each of these tables, values that differ by greater than 5 percentage points are highlighted in grey. Note that sale prices were not available for all properties, so the number of homes in the calculations may differ by category.

Table 2. Economic and Social Indicators for Homes in Michigan & South Carolina field studies

Indicator	State	Number of sampled homes below indicator	Number of sampled homes above indicator
Median Sale Price	MI	62	63
	SC	63	63
State poverty level	MI	12	114
	SC	15	112
State median BIPOC population	MI	112	14
	SC	83	44

Table 3. Ceiling Insulation Non-compliance Percentages by Economic and Social Indicators

Indicator	State	Ceiling Insulation R-value		Ceiling Insulation Quality	
		% of homes below indicator that are non-compliant	% of homes above indicator that are non-compliant	% of homes below indicator that are non-compliant	% of homes above indicator that are non-compliant
Median Sale Price	MI	16%	5%	15%	14%
	SC	14%	11%	33%	19%
State poverty level	MI	17%	10%	0%	17%
	SC	13%	13%	40%	23%
State median BIPOC population	MI	10%	14%	14%	21%
	SC	13%	11%	24%	27%

Table 4. Frame Wall Insulation Non-compliance Percentages by Economic and Social Indicators

Indicator	State	Wall Insulation R-value		Wall Insulation Quality	
		% of homes below indicator that are non-compliant	% of homes above indicator that are non-compliant	% of homes below indicator that are non-compliant	% of homes above indicator that are non-compliant
Median Sale Price	MI	35%	24%	16%	14%
	SC	2%	2%	29%	22%
State poverty level	MI	33%	30%	17%	16%
	SC	0%	1%	60%	20%
State median BIPOC population	MI	29%	36%	14%	29%
	SC	0%	2%	22%	30%

Table 5. Air Leakage Non-compliance Percentages by Economic and Social Indicators

Indicator	State	Home Envelope Leakage (ACH50)		Duct Leakage (cfm25)	
		% of homes below indicator that are non-compliant	% of homes above indicator that are non-compliant	% of homes below indicator that are non-compliant	% of homes above indicator that are non-compliant
Median Sale Price	MI	5%	8%	35%	25%
	SC	6%	2%	16%	8%
State poverty level	MI	0%	7%	42%	29%
	SC	7%	4%	13%	13%
State median BIPOC population	MI	5%	14%	29%	36%
	SC	4%	5%	13%	14%

Table 6. Number of homes in the studies by Metro and Rural Geographies

Indicator	State	# homes
Urban Metro Areas	MI	111
	SC	110
Rural/Other Areas	MI	15
	SC	17

Table 7. Non-compliance for all Measures by Metro and Rural Geographies

Indicator	State	Ceiling insulation R-value	Ceiling insulation quality	Wall insulation R-value	Wall insulation quality	Home Envelope Leakage	Duct Leakage
Urban Metro Areas	MI	10%	16%	29%	15%	6%	32%
	SC	11%	25%	2%	25%	2%	11%
Rural/Other Areas	MI	13%	0%	33%	13%	7%	13%
	SC	24%	29%	0%	29%	18%	24%

Each state has a median poverty level of approximately 13%. By contrast, there were only 12-15 out of 126 census tracts included in each states' field study had levels of poverty higher than the states' median. While unsurprising given the dependence of home construction on local economic development, this reveals a limitation in the sampling. With these small samples, we cannot draw firm conclusions about the correlations between local poverty levels and efficiency measures; however, we note that below-median home values and higher levels of poverty in the surrounding neighborhood were both correlated in South Carolina with higher non-compliance for ceiling insulation quality (40% non-compliant) and even more notably for wall insulation quality there (60% non-compliant). These results, though minimally sampled, are consistent with the national results reported by Nambiar et al. (2023). There is also a possible correlation between homes in census tracts with above-median BIPOC populations and higher non-compliance in wall insulation quality. In Michigan, for the 14 census tracts above the median of 22% BIPOC, 29% were non-compliant for wall insulation quality, compared to 14% non-compliance in tracts below the median BIPOC population. In South Carolina, 30% of homes were non-compliant for wall insulation quality in the 44 census tracts above the median of 31% BIPOC, compared to 22% non-compliance in the other census tracts. Duct leakage issues were more prevalent in the Michigan field study (30% non-compliant), with possible correlations between poor compliance for duct leakage and below-median home values (35%), and higher-poverty (42%), higher-BIPOC (36%) communities.

Metro area geographies with RUCA codes 1-3 are dominant in the sample, and the presence of above-median home sale prices (3 non-metro homes in the study sold at or above $1M) in rural geographies in Michigan suggests that lakefront properties in rural areas may have some effect on the sample distribution for home value there. With these possible complications, it is difficult to draw conclusions about rural or urban correlations with study measures, though we note that air leakage items are less compliant to the code in rural South Carolina samples, and both ceiling insulation quality and duct tightness are less compliant in Michigan urban metro areas. Ceiling insulation quality has been noted as a prevalent issue in national energy code field studies (Blanding et al. 2022). Since insulation quality and duct tightness revealed more non-compliance in both states, those measures may show more promise for deeper analysis in this dataset and in other national field studies.

Retrofitting Field Studies

Residential field studies that sample new-construction homes across a state are perhaps not well-positioned to inform an equity analysis. Sampling processes in field studies are driven by where construction activity is occurring, but to better assess how field studies can shed light on causes of varying code compliance, future field studies could consider additional samples in rural communities, areas with populations nearer to the state norms for percentage of residents in poverty and/or racial diversity. Indeed, oversampling to gather more robust samples in areas with these characteristics – particularly in rural communities with significantly less new construction activity – is a critical approach that will allow field studies to speak to broad factors that may impact compliance in the future.

Additionally, field collection teams can build a strategic approach that engages a wider variety of housing price points and locations within the overall sampling plan parameters. This may include assessing square footage, typical sale price of nearby and comparable homes, size of the builder, and other characteristics that may enable field teams to draw out a more varied sample of new homes. While the proposed approach would be more time-consuming than the original process, it could ensure that field studies are as robust as possible and can speak to broader issues.

In all of this, it is critical to coordinate with local stakeholders and building officials to identify the key questions and community characteristics to be considered. In South Carolina, for instance, the Southeast Energy Efficiency Alliance worked with an advisory group comprised of building officials, builders, utilities, and other stakeholders to identify key research questions and geographic characteristics that would guide the field study, including oversampling in rural communities (where possible). This approach ensures that research questions can speak to real needs of stakeholders working on code/housing, while also identifying local characteristics that may be shaping the landscape of code compliance in each community.

Conclusion

The present analysis of code compliance of selected key items in residential field study data in Michigan and South Carolina demonstrates that while field studies have successfully identified technical compliance gaps, they have historically overlooked how these gaps intersect with socioeconomic and demographic inequities. By integrating census-based indicators with standardized field study data from Michigan and South Carolina, we show some examples of how energy code compliance is not uniformly distributed across communities or jurisdictions. Although many measures exhibited similar compliance rates across neighborhoods, high savings-potential items including insulation quality and duct tightness show patterns of poorer performance in census tracts with lower home values, higher poverty rates, or higher proportions of BIPOC residents.

These findings should be interpreted in the context of the underlying sampling approach of residential field studies, which are driven by new building permit activity. Since new home construction is predominantly in areas of economic development or population growth, these studies will typically be structurally biased towards communities where disparities in energy code compliance may be less pronounced. Within this context, the appearance of equity-relevant patterns, despite limited sample sizes in some cases, suggests disparities in new home construction nonetheless may align with broader national research indicating that communities with fewer resources often bear disproportionate burdens from substandard housing conditions.

The implications of these findings extend beyond energy consumption, and whether via residential energy code field studies or another approach, this analysis motivates further investigation of potential socioeconomic and demographic inequalities in code compliance for new residential construction. Because energy codes function as health and safety codes, inconsistent enforcement can exacerbate pre-existing disparities in comfort, indoor air quality, utility burden, and long-term affordability. As a result, families in under-resourced communities may face elevated risks and reduced financial stability over time. While the present analysis provides only partial evidence for inequalities in code compliance, it highlights a critical gap in measurement approaches and motivates future research that could better align sampling with equity objectives. Understanding these inequities is therefore essential not only for advancing energy efficiency, but also for addressing broader social determinants of health and housing justice.

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