Energy Codes, Home Size, and Equity

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ABSTRACT

Today's new single-family homes are nearly 150% the size they were 40 years ago despite a steady decrease in household size over the same period. In a time of climate and housing crises, "right-sizing" new homes is a clear opportunity to decrease energy use while increasing home affordability.

Energy codes are a viable yet lightly used policy lever for helping to counteract the socioeconomic forces that have contributed to home oversizing. Requiring different levels of efficiency for different sized homes is morally ambiguous: is it equitable to require fewer efficiency measures in small homes if it increases affordability? Further, little research has been done on how much impact energy code advancements have on new home prices and how much reduction in code requirements would be needed to compel homebuilders to build smaller.

This paper discusses the factors that have contributed to home oversizing and investigates approaches taken in state (Washington and Oregon) and national (IECC) energy codes to promote right-sizing of homes. Analysis of trends in new home sales prices and code adoption across regions are contrasted with industry claims that energy codes significantly decrease home affordability. Lessons learned are distilled into recommendations for jurisdictions considering using energy code as a tool to right-size new homes.

Introduction

The United States is currently in a housing affordability crisis. Building more new homes is one of the most direct ways to address this crisis, as this should reduce the price of housing through basic supply and demand principles. However, the affordability gap for new homes is severe. According to the National Association of Home Builders (NAHB), 77% of households in the US cannot afford the median priced new home ($495,750), but about 50% of US households cannot afford a home at even half that price ($250,000) (NAHB 2024a). Thus, simply building more new homes the same way is likely insufficient on its own to put home ownership within reach for much of the population. Increasing supply and decreasing cost of new homes in the short term, while market forces work in the long term to reduce prices across the entire housing stock, could more broadly address the housing affordability crises.

Some construction industry stakeholders have identified building code reform as an opportunity to improve affordability. Their argument is that decreased regulatory burden would increase construction starts, accelerate project throughput, and reduce prices for homebuilders (and, in turn, buyers). Building energy codes have been identified in particular as a potential place to reduce regulations due to their significant increase in complexity and cost over the past 15 years. For example, the Building Industry Association of Washington (BIAW) called for Washington to "review the state's Building Codes to limit them to health and safety" as the state proposed to significantly advance its energy code (BIAW 2023).

While groups like BIAW typically support reductions in code regulations for all homes, other stakeholders are interested in having the stringency of the energy code be a function of home size. Given the intuitive correlation between the size of a home and its price, promoting

construction of smaller homes that tend to be less expensive is a logical approach to making homes more affordable. A less stringent energy code for small homes could increase supply of small homes (by incentivizing homebuilders to shift their behavior and build smaller homes) and reduce price for small homes (assuming at least some of the construction cost savings are passed on to the home buyer).

However, stalling or reversing energy code advances in pursuit of increased housing affordability has considerable negative consequences for both the occupants of the impacted homes and for society. While policymaker narratives regarding the housing crisis typically focus on enabling the purchase (first cost) of the home, the ability of these new homeowners to stay in their homes is clearly a critical policy objective as well. Energy codes not only reduce monthly energy bills but also mitigate the risk of large unexpected costs like hospital visits, home repairs, and extended power outages through improved indoor air quality, durability of building components, and resiliency during storm events, respectively. More broadly, weakening energy codes detracts from societal benefits like improved power system economics and reduced greenhouse gas emissions. As such, effectively pitting the housing crisis against the climate crisis raises many equity questions. Consequently, few energy codes seek to set different levels of stringency for homes of different sizes.

How do Energy Codes Currently Address Home Size?

Washington. Washington state has long required different efficiency levels for different home sizes. Starting with the 2009 Washington State Energy Code (WSEC) version, "small" homes (less than 1,500 square feet (sq ft)) did not have to achieve as many additional efficiency credits as "medium" size homes, while "large" homes (greater than 5,000 sq ft) had to achieve extra credits (WA SBCC). These 1,500 and 5,000 sq ft thresholds have remained consistent in each of the four subsequent WSEC versions.[1] As Table 1 illustrates, the WSEC has increased the incentive for developers to build "small" homes over time by increasing the gap in the number of credits needed between small and medium homes. The difference in number of credits required for small and medium homes has grown from one credit to two to three, while the difference between medium and large homes has stayed consistent.

Table 1. Additional efficiency credits required by the Washington State Energy Code

WSEC Version	Effective Date	Small Home	Medium Home	Large Home
2009	Jan. 2011	0	1	2
2012	Jul. 2013	0.5	1.5	2.5
2015	Oct. 2017	1.5	3.5	4.5
2018	Feb. 2021	3	6	7
2021	Mar. 2024	5	8	9

Source: Washington State Building Code Council.

One might assume that this home size element would incentivize building homes less than 1,500 sq ft. However, Washington new home size data does not show an obvious impact of

[1] These requirements originally only applied to new one- and two-family homes and townhomes. Separate efficiency level requirements for Group R-2 (multifamily) occupancies and for additions less than 500 square feet and were added in the 2015 WSEC and continue through to the current version, 2024 WSEC.

this provision relative to other states: an analysis of homes built since 2018 in each state found that Washington was not among the top 10 states whose new home sizes had decreased relative to the housing stock built before 2018 (AHS 2022). Furthermore, a 2022 study of 178 single-family new construction permits under the 2018 WSEC did not reveal any obvious clustering of homes below the 1,500 threshold (NEEA 2022).

Oregon. In Oregon, the state's Residential and Manufactured Structures Board (RMSB) directed the state to investigate consideration of home size in its residential energy code to inform the possibility of requiring different efficiency levels for different sized homes. In its response to the RMSB, the Oregon Building Code Division (BCD) views this matter through the lens of total home energy consumption and appears to be open to the concept of smaller homes having less stringent energy efficiency requirements (because a less efficient small building could have equivalent total energy consumption to a more efficient larger building) (OR BCD 2023). A code change proposal to introduce additional efficiency requirements for very large homes – while not introducing an analogous mechanism for small homes – was submitted as part of Oregon's 2024 Residential Reach Code development process but was not incorporated into the reach code draft.

International Energy Conservation Code (IECC). The Oregon Residential Reach Code proposal was closely inspired by a new change in the model energy code. Once published, the 2024 IECC will introduce a new provision requiring very large homes to achieve a higher level of efficiency. Specifically, homes with over 5,000 square feet of living area above grade will be required to achieve additional efficiency credits (Prescriptive Path) or demonstrate five percent further energy savings (Performance Path) (ICC 2022). The original proposal for this code change mirrored the WSEC threshold (5,000 square feet of conditioned floor area), but stakeholders ultimately weakened the provision and changed the terminology en route to final approval of the new provision.

How Much Does Energy Code Impact Home Costs?

The existing body of research on the connection between energy code costs and home prices is limited and largely outdated. A 2005 paper that surveyed available theoretical and empirical data found that building codes increase housing costs by 5 percent or less (Listokin and Hattis 2005). While this study provides useful context, it is of limited use for assessing the modern impact of energy codes: while other building codes comprised a much larger share of costs in 2005, the latest model energy codes have since improved the modeled energy use intensity of new homes by over 30% and now comprise a much larger share of building code costs.

Theoretical Analysis

Some industry groups have claimed that energy codes impose a significant budget increase for new home projects. For example, a 2021 NAHB study claimed that the national average incremental construction cost of the 2021 IECC is $6,548-$9,301 more than the 2018 IECC depending on the additional efficiency package option selected for compliance (HIRL 2021). As part of its analysis of each IECC version, Pacific Northwest National Labs (PNNL) estimates the incremental cost of meeting the new code version with respect to previous versions. PNNL calculated that the national average 2021 IECC incremental cost for its single-family

home prototype is $2,372 – nearly two thirds less than the low end of NAHB's claim (PNNL 2021). As illustrated in Table 2, summing all of PNNL's code-to-code incremental cost estimates from the 2006 IECC (essentially the least efficient energy code enforced anywhere in the US) to the 2021 IECC (the latest available version) results in an incremental cost of $4,000 to $6,500 depending on the Climate Zone (CZ) – or $5,000 to $8,000 when adjusted for inflation. However, this code-to-code approach may ignore efficiencies of combining measures together and overstate the true cost; PNNL elsewhere estimates the cost of going straight from 2009 to 2021 IECC to be $5,500 for a single-family home (HUD 2023).

Table 2. Incremental cost of IECC versions for single-family home prototype (2023 dollars)

	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8
2021 vs. 2018 IECC	1,058	1,729	2,101	4,166	4,033	1,669	3,367	3,370
2018 vs. 2015 IECC	0	0	85	85	57	57	57	57
2015 vs. 2012 IECC	11	11	11	11	11	11	11	11
2012 vs. 2009 IECC	2,173	2,613	3,312	2,666	2,099	3,664	3,664	3,664
2009 vs. 2006 IECC	1,983	1,983	2,030	824	1,230	1,278	878	878
2021 vs. 2006 IECC	5,225	6,336	7,539	7,752	7,430	6,679	7,977	7,102

Inflation accounted for with the U.S. Bureau of Labor Statistics CPI Inflation Calculator, using the midpoint (July) for each year. *Source*: Pacific Northwest National Laboratory.

The significant difference in energy code costs between claims made by industry groups like NAHB and the engineers and economists at PNNL can perhaps partially be explained by supply chain impacts for which the PNNL methodology does not consistently account. The balance of the cost difference may be due to industry including the cost of rework related to energy code provisions. Such costs are avoidable and should be considered separately, as potential solutions like engaging in energy code training or soliciting official code interpretations are available to address this disconnect without needing to weaken the code.

Empirical Analysis

In 2023, BIAW claimed that building codes since the 2009 code versions "have added $39,876 to the cost of building a new home, with a majority of that cost borne from the energy code" (BIAW 2023). BIAW further claims that these advancements in the energy code and others account for 10-11% of new home construction costs and about 6-7% of house price.[2] The true cost of energy codes in practice is difficult to ascertain due to several factors such as inconsistent code enforcement, frequent local amendments to the energy code, and low granularity of publicly available new construction data (which the US Census typically only reports at the regional level: New England, Midwest, South, and West).

If energy code costs were indeed of this magnitude, it follows that states with advanced energy codes should have noticeably higher new home prices after updating their energy code – particularly to the 2009, 2012, or 2021 IECC levels per Table 2. Isolating the impact of energy codes on home sales prices across geographies is difficult due to differences in cost of living,

[2] Notably, the total cost of regulations BIAW reports is precisely the difference between the base costs (including land, labor, and materials) to build a median priced home and the median home sales price – which appears to omit or obscure builder profit.

differences in relative supply compared to demand (i.e., how "hot" a market is), and the impossibility of perfectly controlling for all the home features and market factors that contribute to home price. Analyzing across large regions, which may help soften the impact of these localized price drivers, provides some interesting results.

Northwest vs. Midwest – Characteristics. The Northeast and Midwest US regions are useful to compare to examine the realized impact of more efficient energy codes on new home prices. As depicted in Figure 1, these regions have roughly the same breakdown of land area across Climate Zones 4A, 5A, 6A, and 7 (and are thus subject to the same requirements of the IECC), but their code adoption situation differs drastically.

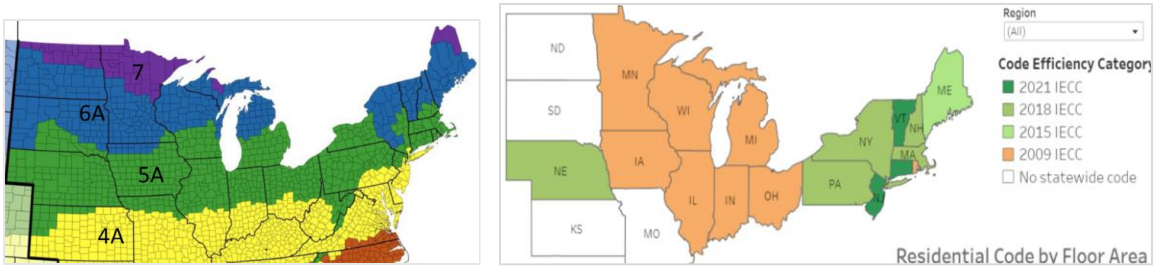

Figure 1. Northwest vs. Midwest Climate Zones and Residential Energy Code Adoption.
Source: U.S. DOE

Per US DOE, 96% of the Midwest's new homes are subject to codes at roughly the 2009 IECC level (77%) or are in a state with no statewide code (19%); localities in these states have limited appetite for adopting or enforcing modern energy codes with the exception of a few cities like Kansas City, MO. In the Northeast (which is adjusted from DOE's regional definitions to include only the states from Maine to Pennsylvania to align with other data sources in this analysis), only 1% of the region's new home square footage is at the 2009 IECC level or worse, while 27% of new homes are subject to the highly efficient 2021 IECC level (DOE 2023a). Since 2020, the Midwest has seen almost no statewide code improvements while every state in Northeast has updated its code. Aside from Illinois's early 2024 code update, which is too recent to impact home prices, the most recent Midwest state energy code update to go into effect was Nebraska's 2018 IECC in July 2020. Meanwhile New York was the least recent Northeast state to implement a new energy code (May 2020), and most Northeast states have updated their codes multiple times over the past decade.

Using DOE's analysis of each state code's site energy use intensity (EUI) and state level residential new construction volume figures from the US Census Bureau to perform a weighted average, the Northeast's new homes are currently about 27% more efficient than 2006 IECC levels while the Midwest's new homes are only about 19% more efficient (DOE 2023a, Census). Thus, Northeast new homes are about 10% more efficient than their Midwest counterparts.[3] This

[3] This is likely an underestimate of the difference because (1) the Midwest calculation did not consider states with no statewide code (effectively assuming the impact of cities with more efficient codes like Kansas City is counterbalanced by low efficiency across the rest of the state, thereby netting out to the regional average) and (2) the Northeast calculation did not consider the impact of the Massachusetts Stretch Code, which is the enforced energy code in the vast majority of the state, and the New York City Energy Conservation Code, which are significantly more efficient than their respective states' base codes and impact considerable construction volume. In both cases this was due to the lack of consistent EUI data.

difference is on the same order of a major code change.[4] If impact of energy code improvements on price is as large as claimed by some industry stakeholders, it should be possible to detect this difference when comparing new home prices across these regions.

Northwest vs. Midwest – Three Year Home Price Analysis. The US Census provides various new home construction figures at the national level and broken down to four regional levels (Northeast, Midwest, South, and West). As illustrated in Figure 2, national house price trends over the past 15 years cut across all regions, and both total and normalized (per square foot) prices are consistently higher in the Northeast (and West) than in the Midwest (and South).[5]

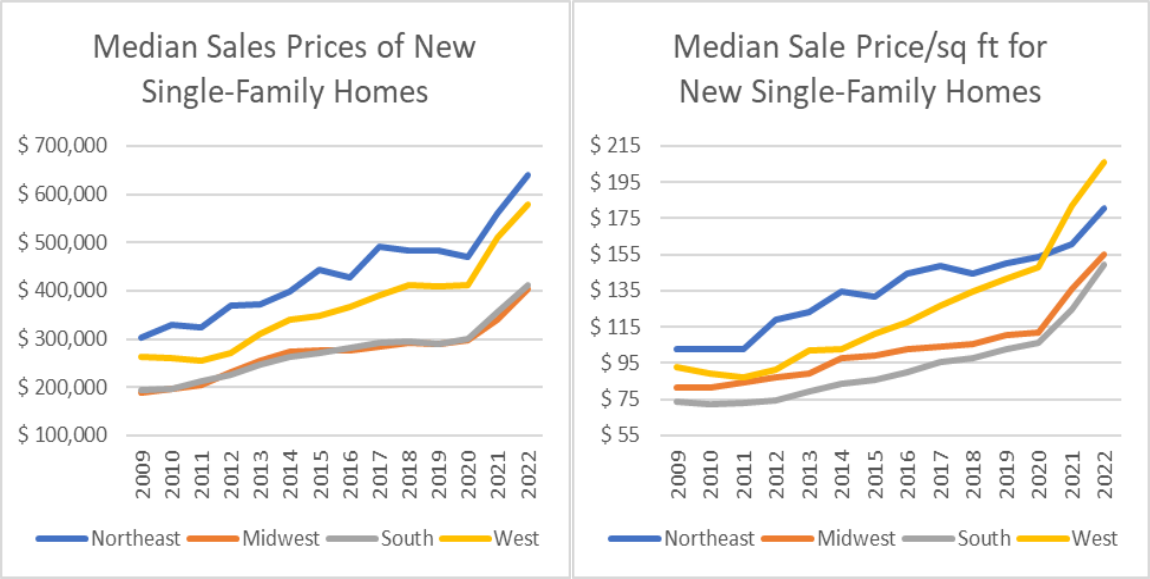

Figure 2. Median Sales Price and Price/Square Foot of New Single-Family Homes, 2009-2022.
Source: Census Bureau

Recall the Northeast states have all updated their energy codes since the start of 2020 while the Midwest has had barely any statewide updates in this time. If energy code does indeed contribute significantly to home price, one would the difference in home price between the region to increase since 2020. While the median single-family house price did increase more from 2020 to 2022 in the Northeast ($158k) than the Midwest ($116k), this is partially attributable to anomalous Northeast new home sizes during this period: while new home sizes everywhere else in the country decreased from 2020 to 2022, the median Northeast new single-family home size increased sharply in 2021 and continued rising to the highest levels ever in 2022 – leaving the median Northeast new single-family home 17% larger than its Midwest analog (Census Bureau).

Examining the normalized ($ per square foot) sale prices helps account for this difference in home size in this regional comparison. Since many energy code features like envelope and ductwork/piping provisions scale roughly with floor area, the increased cost of energy code compliance should be reasonably well captured by the normalized price metric. From 2020 to 2022, the median new single-family home's sale price in the Northeast increased by $30/sq ft

[4] The national average 2021 IECC efficiency improvement over 2018 IECC was 9.3% (DOE 2023a).
[5] This is likely largely attributable to the same factors that drive the cost of living disparity between the regions.

while Midwest homes saw an even higher $45/sq ft increase over this period. Furthermore, the difference in Northeast and Midwest normalized home prices was smaller in 2021 and 2022 (about $25/sq ft) than they have been since 2010. If modern energy codes cause massive price increases, one would have expected to find the opposite results in both cases.

Northwest vs. Midwest – Ten Year Home Price Analysis. Extending this approach further back in time likewise reveals no obvious evidence of energy code impact on new home prices. Table 3 collects all the new statewide energy codes that have gone into effect in the Northeast since 2013 and filters for high efficiency improvement[6] and significant portion of the regional new home market impacted by such changes. This filtering results in three instances with the most expected impact on regional new home prices. The anticipated date for the onset of these top three potential "price spikes" accounts for the 6 to 12 month lag between the code effective date and when homes subject to these new codes begin to be completed and sold. Table 3 also includes the year-over-year (YoY) incremental sale price for the median new single-family home in the Northeast region.

Table 3. Significant Northeast energy code changes and home price impacts, 2013-2023[7]

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
States with energy code update going into effect	RI	MA	VT	CT, NY	MA	PA, CT	RI	NY, VT, MA	ME	RI, PA, NJ, CT	NH
>5% energy efficiency increase?	N	Y	Y	Y, Y	N	Y, N	N	N, Y, Y	Y	N, N, Y, Y	Y
>20% of Northeast floor area impacted?		N	N	Y		Y		N	N	Y	N
Price Spike Expected				2017		2019				2023	
Northeast Δ $/sq ft YoY	$4	$11	-$3	$13	$5	-$4	$6	$3	$7	$20	TBD

The 5% efficiency gain filter sorts out 2012 IECC to 2015/2018 IECC level code updates. Floor area based on historical construction averages. All codes remaining post-filter had effective dates in September or October.
Source: U.S. DOE, Census Bureau

While the normalized home cost data for Northeast from 2014-2022 in Figure 2 above does have a steplike shape reminiscent of code cycle impacts, Table 3 shows that the timing of these steps does not align with the timing of expected price spikes from energy codes. Two of the expected "price spike" years (2017 and 2019) were average YoY price increases during this period; analysis of the third potential price spike (2023) is pending data availability. In fact, none of the top four price increase years during this 10-year period where data is available during this

[6] i.e., moving from 2009 IECC to 2012 IECC levels, or from 2012/15/18 IECC to 2021 IECC levels.
[7] An analogous exercise was performed for the Midwest using these filtering criteria, but no "price spike" years were identified.

period were during one of the anticipated spike years or any of years immediately following. Therefore, there is no obvious impact of energy code on new home prices over this 10-year study period despite these two regions being very similar climactically but nearly opposite in terms of energy code advancement during this period.[8]

What Does Drive New Home Prices?

Luxury Finishes

The efficiency features required by energy codes are some of the only home amenities that provide a direct monetary payback and help the homeowner continue to afford to live in their home. Many other construction costs, including aesthetic amenities like granite countertops that were once considered luxury but have now become fairly mainstream in new homes, provide no such value. Such luxury finishes could be removed from project budgets to make new homes more affordable without compromising long-term affordability and other policy priorities.

Home Size

New homes in the US are about 1.5 times larger than in 1980 and have nearly doubled in size since 1940 despite the average household size decreasing by 16% over the same timeframe (Zebra 2023). Since the residential new construction market serves small and large families alike, reducing the size of new homes is a clear opportunity to increase home affordability.[9] Unsurprisingly, home buyers are responding to their decreased ability to afford new homes by demanding smaller homes – around 2,070 sq ft compared to 2,260 sq ft 20 years ago, according to a 2024 NAHB survey (NAHB 2024b). Despite this, the median new home in the United States is about 2,400 square feet (NAHB 2024c). In summary, new homes are, on average, larger than what the market needs, wants, and can afford.

However, reducing home size does not appear to be a panacea for making new homes more affordable. As illustrated in Figure 3, home size and price have become less and less correlated in recent years. Before 2020, median home size had been on the decline since peaking in 2015. The COVID-19 pandemic spurred demand for bigger homes, causing home sizes to rebound briefly from 2021-2022. Home sizes then fell in 2023 to the smallest median levels since 2010, which has been attributed to the market beginning to respond to the market's reduced ability to afford homes. Housing prices, on the other hand, continued rising even after home size began to decrease after 2015. From 2021 to 2022 house prices rose sharply, far outpacing the modest home size increase. While sold housing price data slightly lags the completed home size data, the past decade of data indicates that there are factors more influential than home size on housing price. As such, policymakers should be aware that actions to reduce home size may not have as large an impact on price as intended, and that other phenomena may be higher order contributors to low housing supply and affordability.

[8] While it is possible that one or more factors not considered in this analysis serve to counteract and mask the energy code's impact on price, other factors that would decrease the relative difference in recent home prices (e.g., controlling for inflation) were also not considered in this analysis.

[9] The recent increase in remote working arrangements is a reasonable argument for a larger home size per person than a few decades ago, but adding an office or extra bedroom to a more "right-sized" home would still be significantly smaller than current new construction norms.

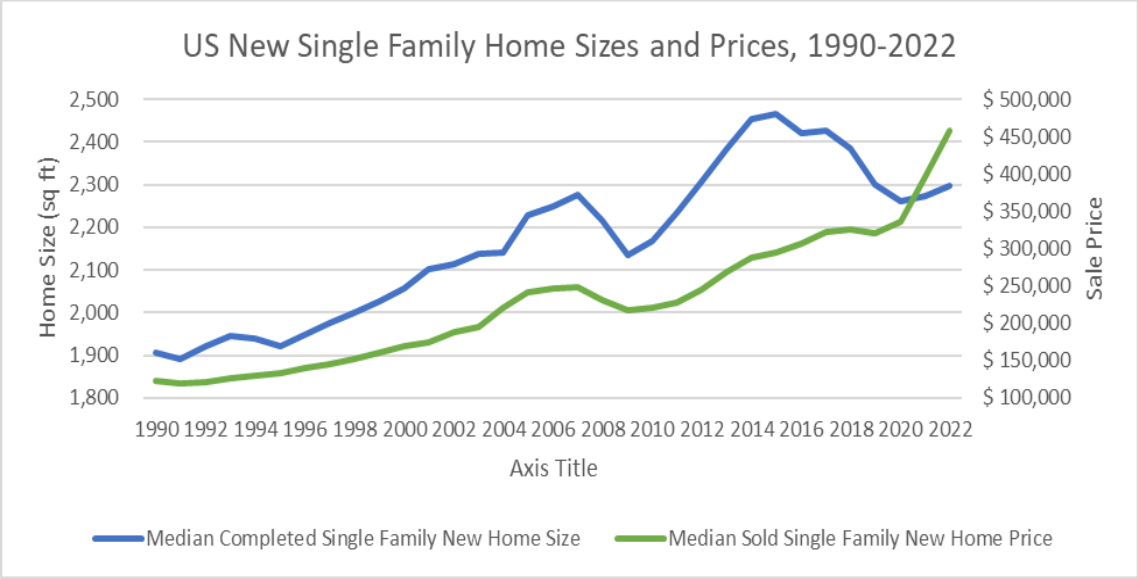

Figure 3. Median sales price and median home size of new U.S. single-family homes. *Source*: Census Bureau

Zoning and Land Use

Zoning restrictions can limit what types of homes can be built in a locality. Multifamily buildings are frequently prohibited, and in some markets single-family detached homes are all that is allowed to be built. Naturally, this reduces the number of housing units that can be built on a given lot, thereby constricting housing supply. In addition, single-family homes are typically more expensive per dwelling unit than duplexes, townhomes, or multifamily buildings: not only is the opportunity cost of economies of scale across units lost, but current real estate economics encourages builders of single-family homes to build very large homes. Areas zoned for single-family only frequently require large minimum lot sizes, and larger revenues are needed to overcome the significant fixed costs associated with acquiring, permitting, and developing large lots. In these cases, profit is typically maximized by building the largest home that can be sold in the market.

While new home sizes have begun to decrease slightly in recent years in recognition of the market's reduced ability to afford such large homes, this systemic encouragement of oversized homes contributes to the large gap between the size home much of the market can afford and what is currently being built. The combination of zoning and land use policies that exclude denser housing types and encourage oversized single-family homes has the two-pronged impact of reducing housing supply and increasing the price of new homes. States and localities have recently identified this connection and begun loosening overly restrictive zoning restrictions.[10] While this will take a long time to impact housing supply and prices due to the low turnover rate of new construction to existing building stock, such efforts promise to repair systemic issues that have contributed to the housing crisis.

[10] Oregon passed the first statewide law prohibiting single-family only zoning in 2019. Since most large cities did not update their zoning regulations until the 2021-2022 effective dates directed by the legislation, it is too soon to measure the impact of this law in increasing housing supply (Bipartisan Policy Center 2023).

Builder Profits, Speculation, and Other Market-Based Factors

A key variable to consider is the degree to which housing costs are passed on to home buyers. In competitive markets, producers will often respond to an increase in production costs by bearing a portion of the price increase through decreased profits. However, in cases of inelastic supply, such as the current housing supply constrained situation, the incremental cost is more readily passed on (i.e., to home sale or rental prices). As such, economic principles indicate it is likely that most if not all incremental costs for energy code compliance are being passed on to home buyers and renters in recent years (WIT, MIT, and HBRAMA 2023). Given this economic principle, it is far from guaranteed that decreases in construction costs from weakening energy codes would be passed on to home buyers as opposed to increasing builder profits. Homebuilder profit margins decreased slightly in 2023 but remain near record high levels (ATTOM 2024), so it seems intuitive that builder profits have also contributed to the stark increase in housing prices that has led to the current affordability crisis.

One trend contributing to reduced housing availability is the increased buying of homes by various parties to be held as assets. House flipping has increased from 5.7% of homes sales in 2017 to 8.4% in 2022 (ATTOM 2023). Flippers reduce the number of housing units available at a given time while also converting homes that are typically lower cost to more luxurious, less affordable versions. Landlords and real estate trusts have also bought up more homes in recent years to rent out, and rent hikes pursued by such institutions has exacerbated the housing affordability crisis. A 2022 MetLife Investment Management forecast projects that institutional investors could control 7.6 million homes, or 40% of US single-family rental homes by 2030 (CNBC 2023b).

Another trend that seems to be reversing is purchase of homes by foreign buyers solely as an investment: the number of purchases by overseas buyers was as low in 2023 as it has been since 2009, and only 10% of Chinese buyers are reportedly purchasing purely as an investment (CNBC 2023a). While international buyers only make up a little more than 2 percent of all buyers, policies that restrict foreign purchase of homes particularly as an investment vehicle could help safeguard housing availability and affordability.

Opportunities: Permitting, Appraisal, and Tax Incentives

Besides reducing home size, reforming zoning and land use regulations, and managing builder profit margins and overspeculation, other available solutions to reduce new home costs without sacrificing energy efficiency include streamlining permitting processes that are frequently burdensome and archaic, mainstreaming the effective use of the Residential Green and Energy Efficiency Addendum to better capture the value of energy improvements in loan underwriting, and creating new tax classifications and exemptions for highly energy efficient buildings (WIT, MIT, and HBRAMA 2023).

Beyond New, Single-Family, Stick-Built Homes

Existing Homes and Accurately Measuring Affordability

In examining the affordability of new homes, the price of new homes is compared to various potential customers and corresponding metrics. Often, the median new home price for

homes in a market is juxtaposed with said market's median income (and, in turn, the payment terms for a 30-year mortgage given the prevailing discount rate and assuming a typical down payment). In other cases, those advocating for reduced regulations and costs to build highlight the difficulties faced by a young family seeking to buy a "starter home." While building new homes is seen as the surest and most direct way to address the housing crisis, new homes constitute only a few percent of the housing stock. As illustrated in Table 4, existing homes are currently significantly cheaper than new homes.[11]

Table 4. Median New and Existing Home Prices (thousand $)

Year	New Home	Existing Home
2020	336.9	300.2
2021	397.1	357.1
2022	457.8	392.8
2023	427.4	394.6

Sources: NAHB 2024b, NAHB 2024c.

To answer the question of who is priced out by unaffordable homes, one must accurately identify the actual market for new construction. Only a subset of the population is in the market to buy a home, and only a fraction of that subset (those with higher incomes or wealth) can currently be considered as addressable market for new homes given their higher cost. In other words, the median new home is not purchased by the median household. More reasonable evaluations of the affordability impact of energy code updates in a market should recognize the true market for these homes similar as was done in a 2023 study on the cost impacts of Massachusetts's new specialized stretch code (WIT, MIT, and HBRAMA 2023).

Manufactured Homes

Discussion of home size, equity, and prudent regulations extend beyond conventional stick-built homes. Manufactured homes, which are built atop a metal chassis, are cheaper than their permanent counterparts and therefore could help alleviate the housing crisis.

Unlike permanent structures, manufactured homes are regulated by the federal government with respect to energy efficiency. The Energy Independence and Security Act of 2007 (EISA) directs US DOE to establish energy conservation standards for manufactured housing and to base said standards on the most recent version of the IECC except in cases where DOE finds the IECC is not cost-effective based on its impact on the purchase price and on total life-cycle construction and operating costs. DOE last updated these standards in 2015 to the 2009 IECC, a version that is now four code cycles behind. In 2021 DOE proposed to update these standards to a level based on the 2021 IECC, thereby catching up on its statutory requirement.

DOE proposed a two-tiered approach based on retail price in light of cost-effectiveness concerns whereby less expensive homes would have less stringent energy standards. A threshold based on square footage was also considered. Ultimately this tiered approach changed to be based on the number of sections of the home in the final rule filed in 2022. Per this rule, single-section manufactured homes have lesser thermal envelope requirements to address affordability

[11] In addition to having fewer modern amenities, existing homes are priced lower simply by virtue of being smaller than new homes on average.

concerns,[12] while multi-section homes' thermal envelope components must achieve full 2021 IECC levels (DOE 2023b). The reduced energy requirements for single-section homes is opposed by energy efficiency advocates who argue the reduced energy bills and other benefits would outweigh the increased costs for this market segment. Interests seeking reduced energy code regulations could point to DOE's decision as precedent for introducing a similar effort to weaken state and local energy codes for small homes; energy efficiency advocates could counter that manufactured homes – and particularly single-section homes – are an existing relief valve for housing affordability that should be considered before taking any further action for permanent structures in the building code. The impact of this new two-tiered approach will not be known for many years as implementation of this new efficiency standard has been delayed.

Balancing Small Homes and Small Energy Bills in Energy Code Design

At what point is it appropriate to set less stringent requirements for smaller homes? In a 2023 memo examining home affordability and the role of the energy codes, Oregon BCD considered establishing an energy consumption budget that all new homes would have to meet regardless of size. This budget would most likely be set by establishing the code measures for a typical, "medium" sized home, then running an energy model with these features to generate the budget. Using this approach, BCD concluded that small new homes may not need any further efficiency improvements going forward since the small home (1,200 sq ft) prototype modeled to Oregon's current energy code was found to consume less energy than the "medium" (2,376 sq ft) prototype would upon reaching the state's statutory 2030 energy code efficiency targets (OR BCD 2023). This concept discourages large homes, but there are several issues with this approach.

First, it does not align with the energy code's purview of achieving the highest level of energy efficiency that is cost-effective and practical. Specifically, imposing an efficiency cap could leave cost-effective energy savings on the table. While this may not be much of a concern if the budget is set to a very high level of efficiency, it ignores the impact of utility incentives, government funding, and other factors that might elevate the cost-effective "sweet spot" to a higher level of efficiency than what is prescribed by the budget approach.

Second, energy use does not scale linearly with square feet. Some loads vary with the number of occupants, and HVAC equipment only comes in discrete capacity options. These factors create a sort of step function in the relationship between energy use and home size that could create significant energy use differences despite small changes in home size. For larger homes, economies of scale are present in home energy efficiency and should be accounted for in shaping any function that specifies a limit for homes of significantly different size.

Third, energy use intensity is heavily impacted by fuel choice, particularly in colder climates. The energy budget would have to be specific to the fuel choice or adjustable for different equipment choices to be effective. This poses a significant technical and political complication to the energy budget approach.

Fourth, the energy budget approach does not allow for the consideration of the value of energy codes beyond energy and utility bill savings, such as improvements to building durability, indoor air quality and occupant health, occupant comfort, and resilience during power outages and storm events. Energy codes are important consumer protection regulations, and all relevant facets of health and safety would be considered to most accurately weigh benefits against costs.

[12] Requirements were limited to stringencies that would increase the incremental purchase price by less than $750.

Finally, and perhaps most importantly, the energy budget concept is not equitable in the long term. Even if the first owner of a new small home, who is likely to be economically well off and not price sensitive to energy bills, is agreeable to paying roughly twice as much for their energy consumption compared to a "medium" home twice its size, the subsequent owners and occupants of the home would be saddled with these higher energy bills. This includes renters, who typically do not have access to accurate home energy cost information when choosing where to rent and often cannot justify making efficiency improvements in their limited duration in the home. Assuming occupancy scales with home size, each person renting the small home in this example would be saddled with energy bills roughly twice that of each person renting a "medium" home built to the same code.

Thus, a 'one-size-fits-all' energy budget approach has several technical shortcomings, does not consider all benefits and costs, and does not achieve equitable outcomes for their occupants over time. Derivation of a mathematical function that instead uses home size as an input to calculate a home-specific energy consumption budget could be a solution if this function adequately accounts for economies of scale, nonlinear loads, fuel choice, and non-energy benefits without requiring energy modeling.[13]

Conclusions

Some stakeholders have proposed reducing energy code regulations to help address the housing crisis. However, there is no clear evidence that this approach will improve supply of smaller homes. Washington's energy code has set less stringent requirements for smaller homes for several cycles, but this does not appear to have reduced the size of new homes. In addition, home price data does not appear to support industry claims that energy codes significantly impact home prices. Comparing the last decade of new single-family home sales price data for the Northeast and Midwest did not show obvious year over year price disparities despite high-construction Northeast states making significant code advancements while the Midwest states remained on older, less efficient code versions during this period.

Thus, other factors likely have a larger impact on housing price than energy codes. Home size has historically been closely correlated with home price, though this relationship has become much weaker in recent years. Zoning and land use policies that promote oversized single-family homes and exclude other housing types can be reformed to positively impact both the housing and climate crises. Other factors like homebuilder profit margin and overspeculation of homes as investment properties are also contributors to the housing crisis and can be adjusted to varying degrees. These factors present opportunities to help address the housing crisis that, unlike weakening the energy code, do not impede efforts to address the climate crisis.

If energy code changes to promote affordability are to be considered, it is critical to use the right metrics and center equity in the policymaking process. So long as new homes remain significantly larger and more expensive, existing home stock and manufactured homes – not new single-family homes – should be considered when measuring the housing affordability gap and assessing energy code impacts on affordability. Furthermore, attempting to achieve energy equity at the home level by establishing a flat per home total energy consumption budget in the

[13] It is also worth noting that the model codes already set a less restrictive EUI for smaller homes than larger homes: for the 2021 and 2018 IECC, the 1,200 sq ft (small) prototype has 2.4% and 7.0% higher national average EUIs than the 2,376 sq ft (medium) prototype, respectively (PNNL 2021).

energy code produces inequitable outcomes for the occupants of the homes built under such a code.

In summary, policymakers that are considering making changes to the energy code in pursuit of addressing the affordability crisis will maximize the likelihood that their actions have the desired impact by more accurately quantifying the impact of the energy code on housing prices, prioritizing policy action on other housing cost drives that have a larger impact, and using the appropriate metrics when designing and assessing policies for different market segments.

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