Energy Efficiency and Housing Affordability
An ICF White Paper
for the Energy-Efficient Codes Coalition
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This white paper addresses two issues that opponents to improved energy codes typically raise:

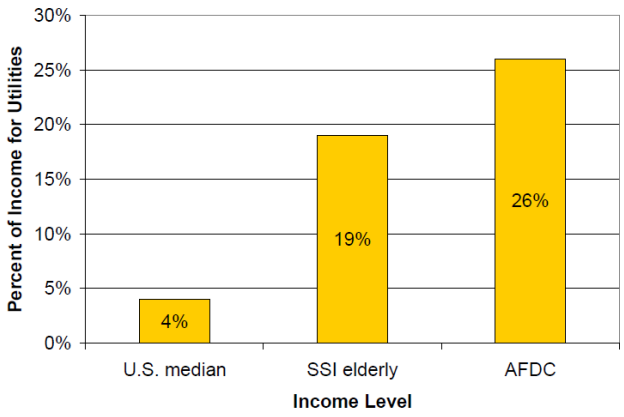
- **Energy efficiency reduces housing affordability**: It is regularly claimed that every $1000 in added construction costs bars 100,000 or more households from qualifying for home purchases.
- **Code improvements should be subject to simple payback analysis:** Opponents assert that a simple payback analysis is the best way to measure energy code cost-effectiveness. They also argue that measures with greater than 5-7 year paybacks are not cost-effective.

Does energy efficiency hurt or help housing affordability?

Energy efficiency is an essential element of housing affordability. After rent or mortgage payments (which typically include property taxes), energy bills are the largest component of home ownership costs. A recent analysis by mortgage industry and energy industry experts showed that utility costs add about 25% to housing costs, with utility costs averaging $226/month. More revealing is the fact that ***when utility costs are added to housing costs, 35% of U.S. markets become unaffordable to average wage earners***.[1]

Efficiency is an even larger factor in housing affordability for retirees and lower- and moderate-income households. These are the most-affected income brackets that efficiency opponents refer to when they claim that efficiency-related construction costs drive people out of the home buying market. Figure 1 illustrates this fact: Social Security recipients pay almost 20% of their income on energy, while federal poverty aid (AFDC) recipients pay more than 25% of their income on energy bills.

Figure 1. Energy Cost Burden as a Percentage of Income



Source: The Affordable Housing Energy Efficiency Alliance. *The Affordable Housing Energy Efficiency Handbook.* http://h-m-g.com/multifamily/aheea/Handbook/AHEEAHandbook.pdf

It could be claimed that lower-income families are more likely to rent than own their homes, which is borne out by national statistics. But this assertion only reinforces the importance of energy codes in making housing affordable: because renters can't choose the efficiency of their homes, energy codes must be in place to protect them. This is why ***the low-income housing advocacy community staunchly supports energy efficient codes***.

[1] https://themortgagereports.com/29733/buying-a-home-utility-costs-matter-a-lot
https://www.attomdata.com/news/company-news/power-conversion/

Do energy efficiency construction costs really drive home buyers' ability to qualify for mortgages?

Even if one accepts the premise that energy efficiency increases construction costs, there are many other factors than the nominal sales price that determine a home buyer's ability to quality for a mortgage. Three of the most impactful factors that lenders take into account are:

- **Availability of down payment:** Regardless of the sales price of a home, buyers must come up with at least 20% of the sale price of the home in order to avoid private mortgage insurance (PMI). PMI, by increasing the mortgage payment, makes it harder for marginal mortgage applicants to qualify. Because efficiency measures account for a small fraction of new home construction costs, their impact on down payment is minimal. The median price of a new home today is about $328,000; a 20% down payment would be about $66,000. While efficiency opponents typically overestimate construction cost impacts of code improvements, realistic estimates would show a minor impact on total costs, and on down payments. DOE's analysis of the 2015 IECC showed incremental construction cost impacts of less than 1% of the average new home price.[2]

- **Creditworthiness:** this is the mortgage underwriter's main focus. It depends both on the borrower's employment history, income history, and total indebtedness, and on the stringency of mortgage qualification methods. Since the mortgage market crisis of 2008, which resulted in part from overly lax underwriting practices, mortgage underwriting criteria and documentation requirements have become much more stringent. Arguably, these new practices have had a much more significant impact on homeownership rates than any other factor. Since the mortgage crisis, the percentage of renters has risen sharply; 37% rent as of 2016, up from about 31% in 2006,[3] even as falling interest rates have kept mortgage payments from rising. Moreover, US household debt has risen substantially, driving ability to qualify for a mortgage down.[4]

- **Mortgage interest rates:** average mortgage rates declined from an average of about 6.5% to 4% from 2007 to 2018[5]. ***The decline in mortgage rates has made today's median home ($328,000) about 25% more affordable, based on simple principal and interest calculations. This factor alone is much more impactful than the effect of energy efficiency on construction costs***: for example, $3000 in added energy efficiency costs would add less than $16 to a monthly payment at 4% interest, whereas a quarter-point increase in interest rates would raise the monthly payment by almost $48, about three times the efficiency impact. Since mortgage interest rates have ranged from under 4% to over 5% in the last two years, interest rates are clearly a more impactful factor than efficiency costs.

Do energy code improvements increase new home prices?

All of the above questions, and efficiency opponents' core arguments, are based on the presumption that energy efficiency-related changes in construction practices increase new home prices. To explore presumption, let's examine the record on new home prices, compared to existing home prices, over the

[2] https://www.energycodes.gov/sites/default/files/documents/2015IECC_CE_Residential.pdf
[3] https://www.pewresearch.org/fact-tank/2017/07/19/more-u-s-households-are-renting-than-at-any-point-in-50-years/
[4] https://www.housingwire.com/articles/48162-americans-are-way-more-in-debt-now-than-they-were-after-the-financial-crisis
[5] http://mortgage-x.com/general/national_monthly_average.asp?y=2007

period since the 2006 IECC created the 21st-century IECC format and set the stringency baseline against which subsequent versions have been measured.

The average real price of new homes rose 21% (in real dollars—22% in nominal dollars) from 2007 to 2018[6], spanning the years that the 2006, 2009, 2012, 2015, and 2018 IECC residential codes became effective. Prices for all homes rose 23% for the same period; ***new home prices thus have risen more slowly than prices for all homes.***[7] This suggests that America's home builders, always looking to manage their costs by modernizing supply chains and construction practices, have found ways to build efficient new homes while making their products more competitive with existing homes.

Is simple payback an appropriate way to measure the cost-effective of energy code improvements?

Efficiency opponents often claim that simple payback is the appropriate method for measuring cost-effectiveness. In addition to this claim, they often then assert that simple payback results should not exceed five to seven years in assessing energy code stringency proposals. Let's examine these assertions in sequence.

Simple payback is calculated by dividing the first cost of efficiency improvements by annual energy savings. For example, an improvement that costs $500 to install and saves $100/year in energy costs would have a 5-year simple payback. While often used in the business world as a gauge for energy efficiency investments for existing commercial buildings or industrial facilities, simple payback is not an appropriate economic measure for policy analysis, or for new home purchase markets. ***Section R101.3 Intent of the 2018 IECC*** states the following text:

> ***"This code shall regulate the design and construction of buildings for effective use and conservation of energy over the useful life of each building."***

The key phrase in Section R101.3 is "over the useful life of each building." This language clearly rules out the use of simple payback, which takes only a first-cost, not a life-cycle cost perspective. IECC code development requires a public policy analysis perspective, which typically includes a life-cycle cost analysis framework. Accordingly, ***the U.S. DOE Residential Energy Codes Cost-Effectiveness methodology uses a life cycle, mortgage-cash-flow based analysis method.***[8] The DOE methodology includes a years-to-positive-cash flow calculation that compares incremental mortgage payments to energy cost savings. For the 2015 IECC, this calculation shows that the typical home buyer would experience positive cash flow in two years or less, when compared to homes built to the 2009 or 2012 IECC versions.[9]

When might a simple-payback method apply to a new home purchase? It might be applicable in situations where a buyer is paying cash. However, cash purchases typically involve one of two types of buyers: wealthy households buying a principal residence, or investors buying income (rental) property. In the first case, wealthy individuals do not have an affordability problem, are not taking out a mortgage, and so the whole affordability question does not apply, and thus there is no reason to constrain code improvements for such buyers' benefit. Investors will typically not be paying utility bills for their

[6] https://www.census.gov/construction/nrs/pdf/uspriceann.pdf (the average 2007 price was $314,000; the average 2018 price was $385,000)
[7] Consumer Price Index data from the U.S. Bureau of Labor Statistics.
[8] https://www.energycodes.gov/residential-energy-and-cost-analysis-methodology
[9] https://www.energycodes.gov/sites/default/files/documents/2015IECC_CE_Residential.pdf

tenants, so they are indifferent to energy efficiency as an economic question. In such situations, the investor faces the split-incentive, principal-agent barrier in which they would pay added capital costs for benefits they do not receive. This barrier typically leads to market failures in which the building or investor, as the "agent" for the "principal" home buyer or renter, is not willing to make the economically rational investments that would minimize home ownership costs over the life of the buildings. It thus has long been a principal policy justification for energy codes, to prevent such market failures.

The great majority of home buyers purchase their homes with mortgages; this is especially true for low- to moderate-income buyers. ***Since the great majority of buyers take out mortgages, for the kind of public policy analysis required in IECC code development, a mortgage cash-flow, life-cycle analysis is the most appropriate method.*** Accordingly, this method is included in the DOE cost-effectiveness methodology cited above.

Based on the facts, as cited in the answers to the questions above, this white paper shows conclusively that:
(a) energy efficiency provisions in recent cycles of the IECC have not measurably harmed housing affordability, and
(b) simple payback is not an appropriate way to consider the cost-effectiveness of energy code improvements.