Executive Summary

ICF was asked to conduct an analysis comparing life-cycle cost (LCC) – the predominant methodology used by policymakers to evaluate the cost effectiveness of residential and commercial building energy codes and other public policies – with two other cost-effectiveness methods: simple payback and mortgage cash-flow. A significant proposal before Congress would designate simple payback as the principal basis for energy code cost-effectiveness. Mortgage cash-flow analysis is typically used in private and public analyses to calculate how energy costs savings offset mortgage payment increases associated with efficiency improvements. Both life-cycle cost and mortgage cash flow analyses account for the longevity of efficiency improvements, a critical omission in simple payback analysis. Both the life-cycle cost and mortgage cash flow approaches incorporate the useful life of various elements in a building, such as high efficiency light bulbs (5 year lifetime) and insulation upgrades (30+ year lifetime). This study provides a rigorous, consistent, quantified comparison of the pros and cons of each of these three methodologies for public policy considerations.

Pre-eminence of Life-Cycle Cost Approach for Energy Codes and other Policies

Policymakers take the life-cycle perspective because buildings can last over 100 years, and only the long view that accounts for all factors affecting the cost-effectiveness of efficiency improvements over the full life of the building can ensure sound public policy decisions. In addition, the International Energy Conservation Code (IECC) – which is the residential building code in 40 states, the District of Columbia, and numerous local jurisdictions in the remaining states – specifically requires that energy efficiency be considered "over the life of the building" (residential or commercial).

In conducting this life-cycle analysis, we employed widely-used and nationally-accepted National Institute of Standards and Technology (NIST) methodologies, and used:

- A nationally-accredited building simulation model to calculate energy savings,
- Recognized federal and industry sources for cost estimates, and
- Industry sources to quantify service life of efficiency measures.

Simple Payback

Simple payback is used principally by private investors to assess the time to recoup the cost of a single energy efficiency retrofit. Its primary attribute is calculation simplicity, but because simple payback fails to consider important financial elements – such as the full useful life of efficiency measures, the ways most Americans actually buy homes, changes in fuel costs and energy bills, discount rates, and tax implications – it is typically not used in public-policy cost-effectiveness assessments. In addition, because the great majority of American home buyers use mortgage financing to buy their homes, simple payback is not applicable to most home purchase transactions. Buyers who do pay cash are typically either investors seeking to rent or flip the property, or wealthy individuals for whom affordability is not an issue.

Mortgage Cash Flow

Building energy codes are developed and adopted to reduce homeowner and renter utility bills, which account for the largest share of home occupancy costs after mortgage payment (or rent) and are the least predictable cost of home ownership. To assess the cost-effectiveness of codes in the context of home occupancy costs, it is most appropriate to apply a mortgage cash flow analysis method, which projects the net occupancy costs associated with code-compliant homes. Tracking mortgage cash flow paints a clear and realistic picture of building energy efficiency to a typical homeowner or occupant, evaluating how quickly energy bill savings help the homeowner reach a break-even point with outlays for efficiency improvements.

Key Findings

All of the methodologies were used to calculate the cost-effectiveness of two IECC stringency increases: (1) the 2006 IECC to the 2012/2015[1] IECC, and (2) the 2009 IECC to the 2012/2015 IECC. Key findings that emerge from this analysis include:

- **The 2012/2015 IECC is cost-effective on a lifecycle basis.** Without exception, the LCC analysis shows net present dollar savings of the 2012/2015 IECC in all U.S. climate zones, whether the baseline code is the 2006 or 2009 IECC.
- **The 2012/2015 IECC delivers actual net savings to typical homeowners in the second year of home ownership.** The mortgage cash flow analysis shows positive cash flow in year 2, including points later in the mortgage term when replacement costs occur.
- **Simple paybacks average less than 10 years.** While paybacks exceed 10 years in some climate zones, on a national average basis, the payback is under 10 years. This contrasts sharply with other studies that show substantially longer paybacks, typically based on very high cost estimates that do not jibe with the recognized, transparent sources used in this analysis.

[1] Because efficiency requirements of the 2015 IECC are virtually identical to those of the 2012 IECC, the energy savings attributed to the 2012 IECC in this analysis are also expected for homes built to the 2015 IECC. In its determination on the residential chapter of the 2015 IECC, the US Department of Energy found savings to be less than 1% greater than the 2012 IECC: "On June 11, 2015, DOE issued a determination that the 2015 IECC would achieve greater energy efficiency in buildings subject to the code. DOE estimates national savings in residential buildings of approximately:

- "0.73% energy cost savings
- "0.87% source energy savings
- "0.98% site energy savings"