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Houstonians Buying 2012 IECC Homes Will Save Thousands

An Analysis of a Homeowner Profit *After* Paying Incremental Construction Costs For New Single Family Homes Meeting Historic Building Energy Code

HIGHLIGHTS

- **Energy cost savings for a 2012 IECC home are estimated at $252 per year ($21 per month), when compared to homes meeting the current energy code.**
- **Break-even on investment — the additional down payment and slight mortgage payment increase — occurs in one year, 10 months.**
- **After the break-even point, homeowners realize a net profit (energy savings less mortgage costs) of $177 annually.**
- **2012 IECC home owners pocket $4,986 in net profits over the length of a 30 year mortgage term.**

SUMMARY

Houstonians buying new single family homes meeting the 2012 International Energy Conservation Code (IECC) will pocket nearly $5,000 in net energy savings over a 30-year mortgage term, according to an analysis of energy savings and incremental construction costs by the Building Codes Assistance Project and ICF, International.

This report assesses energy savings and incremental construction cost increases of new, 2,400 square foot single family homes in Houston that meet the latest model energy code, the 2012 IECC, compared to the code in effect in 2011. Specifically, this analysis conservatively estimates that an average new home meeting the 2012 IECC will cost an additional $1,623 over the construction costs of meeting the energy code in effect last year(2006 IECC + 15 percent). This represents an estimated increase in the first-cost of a new home of between 0.39 and 0.59 percent.[1] **At $252 per year, however, energy cost savings are significant.**

The energy savings from the 2012 code are enough to pay back the buyer's additional down payment and slightly increased mortgage cost in one year, 10 months (*sooner if the homebuyer puts less than 20% down*). **After that date, the owner continues to pocket a profit (energy savings minus mortgage costs) of $177 annually—money that would otherwise go to pay higher utility bills.** These net savings will be even greater if energy costs rise over the next 30 years consistent with historical trends.

ENERGY SAVINGS AND CONSTRUCTION COST METHODOLOGY

To calculate energy savings and incremental construction costs, this analysis defined a "typical" single family house to represent new residential development in Houston. The home modeled is two stories in height, with exterior dimensions of 30 by 40 feet with wood-framed 2 x 4 walls and a slab on grade foundation. This size and foundation type is based on regional construction practices. In Texas (as

[1] The U.S. Census Bureau estimates that the average new home sold in 2010 (including land costs) was $272,900 with an average square footage of 2,392—only eight square feet smaller than the model in this analysis. With this price as an estimated baseline sale price, incremental costs would add less than six tenths of one percent (0.06%) to the cost of an average new home.

nationally) the average new home is approximately 2,400 square feet—which is the size used in this analysis.

For the purposes of this analysis we assume a baseline home that meets the requirements of the 2006 IECC + 15 percent, which is Houston's current code. While builders have a variety of options to meet the existing code's required 15 percent efficiency improvement over the 2006 IECC, the inspections department in Houston indicated that most builders choose Compliance Method #2, which calls for builders (or their designee) to run RESCheck software and also perform duct and whole house pressure testing. Although some leading builders in Houston are already building to a higher standard or electing other methods to achieve a 15 percent improvement, the inspections department in Houston indicated that this is the most common, expedient, and low-cost method for achieving compliance with the code.

Using this model home as a baseline, we identified the building components that would have to be upgraded from the current 2006 IECC + 15 percent code, to meet the prescriptive requirements in the 2012 IECC. These changes included upgrades to attic insulation from R-30 to R-38 blown-in insulation, an upgrade of windows, an increase from zero to 75 percent compact florescent bulbs in hard-wired fixtures, R-3 insulation on hot water pipes from the hot water heater to kitchen, an upgrade of insulation and weather sealing for attic access hatches, and a programmable thermostat.

Energy savings were modeled by ICF International (ICFI), an international energy consulting firm with extensive experience in the use of hourly building energy simulation software to estimate energy performance and energy savings of alternative building codes and design concepts. Although the numbers included in the analysis represent a careful, independent technical judgment by ICFI staff, it should be kept in mind that – like any such analysis – the results depend on a number of assumptions about the physical features of a typical new home, operating practices, energy prices, and other factors.

Both the existing 2006 IECC + 15 percent code and the new 2012 IECC code allow a builder to choose among a number of alternatives to comply with the code. In this case, ICFI conservatively chose to compare the results from the prescriptive path of each version of the code. ICF uses BeaconTM, an hourly simulation model that utilizes DOE-2 or EnergyPlus, and summarizes building performance in terms of estimated annual energy costs, based on long-term average weather conditions in a given climate zone (city), DOE/EIA state level energy costs. ICF also estimates energy consumption by end-use, fuel type, electricity peak demand, and air conditioner size in each prototype home. More details of the modeling assumptions used in this analysis are available on request.

INCREMENTAL COSTS

This analysis conservatively estimates incremental construction costs for the average new home in Houston to be roughly $1,623. These estimates are derived from a variety of sources, drawing on construction cost estimating software, experience in neighboring states, and local building suppliers. Costs are described below and summarized presented in table 1, below.

To estimate incremental costs for ceiling (or attic) insulation, we rely on estimated construction costs from the well-regarded *2011 RS Means Contractor's Pricing Guide*. To approximate actual costs of new home construction, the total incremental cost from RS Means includes material costs, labor, and contractor overhead and profit. The additional cost associated with an upgrade from R30 to R38 blown-in insulation is estimated as $302.40.

Builders will also need to make window upgrades to meet the 2012 IECC. To meet the improved u and SHGC factors for the 2012 IECC (.4 and .25, respectively) our analysis expects that window frame material must be upgraded from aluminum to vinyl with low-e gas between panes. This added cost is conservatively estimated by the Efficient Windows Collaborative (EWC) as $4.00 per square foot—making it the largest proposed incremental cost in a move to the 2012 IECC. It is important to note that some builders may already install windows that meet the 2012 IECC requirements, but in an effort to be conservative (and strictly compare the two codes) this analysis assumes that builders are currently using the least-cost window to meet existing code requirements.[2]

As well, to meet the 2012 IECC builders will have to install programmable thermostats in lieu of manually controlled units, a change estimated at $50. Also, high-efficiency lights are required in 75 percent of hard-wired fixtures, which is not required in the 2006 IECC. Usually, this requirement is met with compact florescent lights (CFLs). Our analysis estimates that the upgrade of 75 percent of light bulbs will cost no more than $50.[3] An additional 2012 IECC code change will require builders to insulate hot water distribution lines to kitchens. We believe the cost impact of this change is small, as R-3 insulation costs less than 50 cents per linear foot and most insulation products can be "clipped" around supply pipes after the plumbing rough-in.[4] As a result, this cost is estimated at $100 per new home.

Finally, to meet the 2012 IECC we estimate an additional $100 to seal and insulate the attic hatch. This cost varies widely by home, and depends on whether or not attic access is achieved through a wall opening (such as a door) or via an overhead pull-down stair. For wall openings, cost is expected to be much lower, as builders can simply adhere surplus insulation to the unconditioned side of the door. For attic pull-down stairs, a variety of kits can be placed over the stairs by builders, but costs are higher. Prior analysis for pull-down stair insulation and sealing completed in conjunction with the Home Builders Association of South Carolina estimated this cost to be $100—an estimate which has also been used in this analysis in an effort to default to the most conservative option.

Table 1: Summary Incremental Cost Analysis for Meeting 2012 IECC

Building Component	Total Area (Sq Ft)	Incremental Cost/ Square Foot	Total	Location Factor[5]	Adjusted Total
Upgrade Attic Insulation from R30 to R38	1,200	$0.30	$ 360	84%	$ 302.40
Window Upgrade to Vinyl low e	357	$4.00	$1,428	N/A	$1,428.00
Upgrade to Programmable Thermostats	N/A	N/A	N/A	N/A	$ 50.00
Insulate Hot Water Pipes to Kitchen	N/A	N/A	N/A	N/A	$ 100.00
75% CFLs in hardwired fixtures (from 0%)	N/A	N/A	N/A	N/A	$ 50.00
Sealing/Insulating Attic Hatch	N/A	N/A	N/A	N/A	$ 100.00
HVAC System Savings	N/A	N/A	N/A	N/A	($407.50)
Total Incremental Costs					**$1,622.90**

[2] As a result, many builders will be able to reduce or avoid incremental costs for better windows.

[3] This is a conservative assumption for several reasons: first, it does not account for the avoided cost of purchasing 8 or more conventional incandescent bulbs that would be needed over the longer lifetime of a CFL. Nor does this estimated added first-cost for CFLs reflect the new federal light bulb standards to be phased in over 3 years (2012-2014), which will require efficiency equivalent to either a CFL or an improved, high-efficiency halogen incandescent lamp, currently priced at about the same first-cost as a CFL but with lower efficiency and shorter lifetime. After the phase-in of new light bulb standards, savings from this code requirement will also be reduced.

[4] It is difficult to determine what combination of redesign, resizing, and/or partial insulation of hot water lines would be done in a typical new home. Insulating distribution lines to the kitchen and very long runs would add costs while downsizing lines would reduce costs; in any case we believe the net effect would be small.

CONSTRUCTION COST SAVINGS

While complying with the 2012 IECC increases first-cost in some areas, the new code also presents opportunities to **reduce** costs for HVAC equipment as a result of an improved building envelope. Among other possible savings, builders will be able to reduce the size of costly mechanical equipment. For this prototype home, builders are able to reduce the cooling system capacity from 48,000 kBtuh to 42,000 kBtuh or from 4 to 3.5 tons. This reduction in air conditioner capacity can result in first-cost savings of approximately $408 for each new house.[6]

ENERGY COST SAVINGS

According to the model used in this analysis, **upgrading to the 2012 IECC will result in energy cost savings for homeowners of $252 per year**. These annual utility bill savings represent energy savings of 13.4% of the home's total energy use that is regulated by the building code. It is noteworthy that these savings assume constant energy prices; if energy prices continue to rise consistent with historical trends, savings will be greater in future years.

NET PROFIT POCKETED BY HOMEOWNERS

Homebuyers will be able to include in their mortgage the incremental first-costs of meeting the 2012 IECC, while benefiting from lower utility bills starting on day one. With estimated energy cost savings of $252 per year, monthly utility bill savings are more than three times as much as the additional mortgage payment needed to cover the added first-cost of energy saving features required by the 2012 code.

This cash-flow difference is enough to pay back the buyer's added down-payment in only one year and ten months (or sooner if the loan allows a down payment below 20%). After that date, the owner continues to save $177 annually in lower utility bills – and even more if energy prices increase.

This payback analysis assumes that homebuyers purchase a new home with 20% down at the current nationwide interest rate of 4.01 percent. This scenario would result in an increased down payment of $325 with additional monthly mortgage cost of $6.21. Taking into account energy savings and lower utility bills, a cash flow analysis indicates that the homebuyer would break even within one year and ten months. After that break-even date, **home owners would continue to save $177 in energy costs**. Homebuyers with a lower down payment—such as 5 or 10 percent—will realize payback much more quickly. Mortgage payback to homeowners for 5 and 10 percent down payment scenarios are presented below in **Table 2**.

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[5] Location factors are used by RS Means to approximate the local cost as a percentage of the national average. In this example, construction is estimated by RS Means to cost 84% as much as the national average.

[6] EPA conservatively estimates for their Energy Star Homes Version 3 that first-cost savings for downsizing a 13 SEER air conditioner are $815 per ton. It should be noted that our energy modeling suggests that the energy savings achieved by the city's baseline code (which includes the addition of a "plus" fifteen percent efficiency improvement from the 2006 IECC) should already allow builders a substantial reduction in cooling capacity of 12,000 kbtuh—the equivalent of 1 ton (and $815 in savings) from the 2006 IECC. If builders have not taken advantage of these savings already, they may have an opportunity to lower their costs by an additional $815. By "right-sizing" the HVAC equipment, building occupants will also benefit from a reduction in equipment short-cycling (i.e., where equipment is too large for the cooling load and cycles on and off frequently, thus wasting energy and losing some of its ability to dehumidify indoor air).

Table 2: Mortgage Payback for Homebuyers by Down Payment Percentage[7]					
	Incremental Costs	Energy Savings/ Month per home	Down Payment Increase (and Mortgage Increase per Month)	Breakeven Point	Annual Profit for Homeowner after Breakeven Point
20% Down	$1,622	$21	$325 (plus $6/month)	**1 years, 10 months**	**$177**
10% Down	$1,622	$21	$162 (plus $7/month)	**1 year, 0 months**	**$168**
5% Down	$1,622	$21	$81(plus $7/month)	**7 months**	**$164**

About the EECC

The Energy Efficient Codes Coalition (EECC) is a coalition of energy efficiency advocates involved in the development of the national model energy codes. EECC draws supporters from government, regional energy efficiency alliances, academia, think tanks, utilities, environmental groups, utilities, low-income housing groups, energy consumers, and businesses. The EECC has been heavily involved in the most recent two cycles of IECC code development. Our partner organizations and supporters are also deeply involved in the processes of state and local adoption and implementation of the model codes.

About BCAP

As an independent judge of the efficacy of energy codes, BCAP strives to use data to address energy code barriers, including the real or perceived construction costs incurred by code changes. To address concern in the building community that upgrading to the latest version of the residential energy code, the 2012 IECC, will result in cost prohibitive increases in construction cost for new single-family homes, BCAP has completed a nationwide incremental cost analysis as well as analysis for states on demand. Funding for this work is provided by the Environmental Protection Agency, the Department of Energy, and the National Association of State Energy Officials. BCAP is a project of the Alliance to Save Energy, a nonprofit organization that promotes energy efficiency worldwide through research, education, and advocacy.

Contact Information:

2012 IECC Adoption and Energy Codes Policy

William D. Fay
Executive Director
Energy Efficient Codes Coalition
(202) 530-2214
bfay@ase.org

Maureen Guttman, AIA
Executive Director
Building Codes Assistance Project
(202) 530-2211
mguttman@ase.org

Technical Analysis

Mark Lessans
Senior Associate, Technical Outreach
Building Codes Assistance Project
(202) 530-2255
mlessans@ase.org

[7] *Assuming 20%, 10% and 5% down payment, respectively. All loans are assumed to have a 30 year term, and the current national average interest rate of 4.01%.

Appendix A: Components of Incremental First-Costs and Energy Savings by End Use