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Dallas Residents Buying 2012 IECC Homes Will Save Thousands

An Analysis of Homeowner Profit after Paying Incremental Construction Costs For New Single Family Homes Meeting the Building Energy Code

HIGHLIGHTS

- **Energy cost savings for a 2012 IECC home are estimated at between $271 and $277 per year ($23 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 33 – 37 months.**
- **After the break-even point, homeowners achieve a net profit (energy savings less mortgage costs) of $159 to $169 annually.**
- **2012 IECC homebuyers pocket $4,294 - $4,607 in net profits over the length of a 30 year mortgage term.**

SUMMARY

Dallas, TX residents buying new single family homes meeting the 2012 International Energy Conservation Code (IECC) will pocket between $4,294 to $4,607 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 Dallas that meet the latest model energy code, the 2012 IECC, compared to the current code in effect, the 2009 IECC. This analysis finds that an average new home meeting the 2012 IECC will add less than 1% to the cost of a new home, costing an additional $2,358 to $2,440 over the costs of homes meeting the current energy code. **Energy cost savings for 2012 IECC homes are significant, and are estimated in this study at between $271 and $277 per year, depending on the exterior wall type used by builders.**

The energy savings from the 2012 code are enough to pay back the buyer's additional down payment and slightly increased mortgage cost in approximately 33 to 37 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 between $159 and $169 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.

Stated differently, monthly **utility bill savings to the homeowner are more than twice as much as the additional mortgage payment** needed to cover the added first-cost of energy saving features included in the 2012 code.

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 Dallas. The home modeled is two stories in height, with exterior dimensions of 30 by 40 feet with wood-framed walls and slab on grade foundation. The model home's size and foundation type is based on regional construction practices, and it contains 2,400 square feet in floor area—which is also the approximate size of the average new home built nationwide.

For the purposes of this analysis we assume a baseline home that meets the requirements of the 2009 IECC, which is the city's current code. Although some leading builders are meeting or exceeding many elements of the 2012 IECC already, for purposes of this analysis we assume a baseline home that exactly meets the requirements of the 2009 IECC.

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 values 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 2009 IECC and the new 2012 IECC codes 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. ICFI 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. ICFI 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

Using the 2,400 square foot model home as a baseline, we calculated incremental costs by identifying the building components that would have to be upgraded from the current 2009 IECC, according to the prescriptive requirements in the 2012 IECC. These costs vary based on the type of exterior wall builders select. To estimate incremental costs, we rely on construction costs from the well-regarded *2012 RS Means Contractor's Pricing Guide* to approximate actual costs of new home construction. This resource is known to be conservative and is useful for this analysis because all estimated construction costs are inclusive of material costs, labor, and contractor overhead and profit.[1] For this analysis, RS Means data is supplemented by additional calls to local building suppliers and experts.

Windows

Dallas contractors will need to make upgrades to installed windows to meet the improved U- factor and SHGC factors in the 2012 IECC. U-factor for windows is upgraded from 0.5 under the current code to 0.35 under the 2012 IECC and the SHGC factor is improved from 0.30 to 0.25. This added cost is conservatively

[1] RS Means also includes a location factor, which provides an estimate of local costs as a percentage of RS Means national average estimates. For this analysis, the location factor for Dallas is 83%, indicating that construction costs in the city are approximately 17% lower than the national average.

estimated by the Efficient Windows Collaborative (EWC) as no more than $1.00 per square foot of window area. It is important to note that many builders may already install windows that meet the 2012 IECC's slightly-improved 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] Total window incremental costs are estimated as $357.

Whole House Air Leakage and Ventilation

We estimate that the additional required air sealing in the 2012 IECC and the required testing for whole house air leakage (commonly known as "blower door") and duct leakage will add about $350 per new home.[3] Because the resulting home will have fewer air and duct leaks to the outside, mechanical ventilation will have to be improved, a cost we estimate at $180 for upgrading one bathroom vent fan to a unit with an Energy Star rating along with the installation of a simple controller which is set to automatically exhaust indoor air.[4]

Hot Water Distribution Lines

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.[5] As a result, this cost is estimated at $100 per new home.

Lighting and Programmable Thermostats

Builders will have to install high-efficiency lamps in 75 percent of hard-wired fixtures, up from 50 percent in the 2009 IECC. Usually, this requirement is met with compact florescent lights (CFLs). Our analysis estimates that the upgrade of lamps in 25 percent of fixtures will cost no more than $25. Builders will also have to upgrade conventional thermostats to programmable thermostats, a cost which is estimated as $50.

Exterior Walls

The 2012 IECC would require builders in Dallas to make changes to a new home's exterior wall construction. At present, the 2009 IECC requires R-13 walls for exterior walls, while the 2012 IECC mandates an insulation upgrade to R-13+5 or R-20 walls.

Building the R-13+5 walls begins with the 2 x 4 walls currently by builders and would replace conventional OSB wall sheathing with structurally insulated sheathing (SIS)[6]—an engineered product that combines structural reinforcement of oriented strand board (OSB) with insulation equivalent to R-5, thus creating an

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

[3] $350 is a commonly used as an expected air sealing and testing cost for new single-family detached homes nationwide.

[4] Ventilation system and costs are described in an August 2005 report from Lawrence Berkeley National Laboratory "Review of Residential Ventilation Technologies." Although the costs of these components have decreased in recent years, the 2005 estimate ($180 per new home) is quoted in this analysis.

[5] 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.

[6] Please note, here SIS is used as a generic term for insulated sheathing products. It does not refer to DOW's SIS, which is currently not available to contractors.

R-13+5 wall.[7] The cost difference of the conventional OSB and R-5 insulation is estimated as $0.76 per square foot of wall area, for an estimated total of 1,813 per new home.

Builders also have to option to meet the wall requirements in the 2012 IECC by upgrading to R-20 walls. To build the R-20 wall, builders will have to upgrade conventional 2 x 4 framing with 2 x 6 framing. The larger framing allows for R-21 fiberglass batts to be placed between studs instead of the R-13 batts required in the 2009 IECC. This cost is estimated by RS Means as $0.67 per square foot of wall area, for a total of $1,595 per new home. It is important to note that this cost may in fact be significantly lower. In fact, due to the superior strength of 2 x 6 stud construction, builders can introduce a cost-saving variant of the R-20 wall that increases the space between wall studs from 16 inches apart to 24 inches—thus saving lumber and dramatically reducing incremental cost. Many builders prefer to retain 16 inch spacing however, and thus this wall assembly is not included in this analysis to ensure it is conservative.

Window Extension Jambs

Builders in Dallas who intend to meet the 2012 wall requirements with R-20 walls may also incur an additional cost for window jamb extensions. These jamb extensions are required because the wall thickness increases with a change from 2 x 4 to 2 x 6 framing. While some window manufacturers offer jamb extensions as a factory-built option, most builders prefer to field-fabricate extension jambs, which are attached to the interior jamb of the window and create a consistent wood or drywall transition between the window and wall. These extensions, essentially four pieces of wood or drywall that "frame" the interior window jamb, are estimated at $300 after a brief survey of installers, who put costs at $10-12 per window.

Extension jambs are not assumed to be an added cost for builders using R-13+5 walls to meet the 2012 IECC, as the difference in wall thickness of OSB and SIS is less than ½ inch.

Attic Insulation

The 2012 IECC also requires builders to upgrade blown-in ceiling (attic) insulation from R-30 to R-38, which is estimated by RS Means to cost an additional $299 per new home.

Cost Savings

Fortunately, the 2012 IECC will also introduce cost savings for builders. 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 the prototype house in Dallas' climate zone 3, builders will be able to reduce the cooling system capacity from an average of 48,000 kBtuh to 36,000 kBtuh or from 4 to 3 tons. This reduction in air conditioner capacity can result in first-cost savings of one ton, which is expected to save approximately $815 for the average new house.[8]

[7] Incremental cost for 13+5 walls relies on local building supply estimates for R-5 or R-6 structurally insulated sheathing (SIS). Incremental costs for walls with SIS do not take into account savings from eliminating a housewrap, a function that is included in SIS panels. Thus, incremental costs for walls should be lower than projected in this analysis

[8] 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. 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). Please note that additional cost savings could be obtainable from downsizing heating equipment, but this study does not attempt to calculate those savings.

Total incremental costs for new homes in Dallas are estimated in Table 1, below:

Table 1: Dallas 2012 IECC Incremental Costs						
Building Component	Total Area	Incremental Cost/Square Ft	Total	Location Factor	Adjusted Total	
Ceiling Insulation Upgrade from R-30 to R-38 (both blown-in)	1,200	$0.30	$ 360	83%	$ 299	
Upgrade Walls from R-13 to R-13+5	2,380	$0.76	$ 1,812	N/A	$1,812	
OR Upgrade Walls from R-13 to R-20	2,380	$0.67	$ 1,595	N/A	**OR**	$1,595
Upgrade Windows to U-0.35 and SHGC 0.25	357	$1.00	$ 357	N/A	$ 357	
Increased Air Sealing and Testing	N/A	N/A	N/A	N/A	$ 350	
Insulating Hot Water Pipes	N/A	N/A	N/A	N/A	$ 100	
75% CFLs in hardwired fixtures (from 50%)	N/A	N/A	N/A	N/A	$ 25	
Upgrade to Programmable Thermostats	N/A	N/A	N/A	N/A	$ 50	
Bathroom Vent Fan Upgrade and Addition of Automatic Timer	N/A	N/A	N/A	N/A	$ 180	
Window Extension Jambs *(only for builders using R-20 walls)*	N/A	N/A	N/A	N/A	$ 300	
HVAC System Savings (downsizing cooling system 1 ton)	N/A	N/A	N/A	N/A	$ (815)	
Incremental Cost (R-13+5 Walls)					**$2,358**	**OR**
Incremental Cost (R-20 Walls)					**$2,440**	

ENERGY COST SAVINGS

According to the model used in this analysis, **upgrading to the 2012 IECC will result in significant energy bill savings for Dallas home buyers, resulting in utility bill savings of between $271 and $277 per year,** depending on the type of exterior wall type builders select. 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. These energy savings allow homebuyers to quickly recapture their incremental costs. Annual energy savings are presented in Table 2, below, by exterior wall type.

Table 2: 2012 IECC Energy Savings by Climate Zone and Wall Type	
Climate Zone and Wall Types	**Annual Energy Savings**
Houses with R-13+5 Walls	$277
Houses with R-20 Walls	$271

MORTGAGE PAYBACK FOR HOMEOWNERS

Homebuyers will be able to include the incremental first-costs of meeting the 2012 IECC in their mortgage, while benefiting from lower utility bills starting on day one. With estimated energy cost savings of between $271 and $277 per year, monthly utility bill savings are more than twice as much as the

additional mortgage payment needed to cover the added first-cost of energy saving features required by the 2012 IECC.

This cash-flow difference is enough to pay back the buyer's added down payment in approximately 33 to 37 months after purchase (or sooner if the loan allows a down payment below 20%). After that date, the owner continues to realize a profit of at least $159 annually due to 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 4.03 percent. This scenario would result in an increased down payment of between $472 to $488 with an additional monthly mortgage cost of $9 per month. Taking into account energy savings and lower utility bills, a cash flow analysis indicates that the homebuyer would break even within as little as 33 months. After that break-even date, **homeowners would continue to realize a profit of $159 and $169 annually,** which is calculated by subtracting additional mortgage costs from energy savings. Homebuyers with a lower down payment—such as 5 or 10 percent—will realize payback more quickly. Mortgage payback to homeowners is presented below in Table 3, below.

Table 3: Mortgage Payback for Homebuyers by Exterior Wall Type

Exterior Wall Type	Incremental Costs	Energy Savings/ Year and Month per home	Down Payment Increase (and Mortgage Increase per Month)	Breakeven Point	Annual Profit for Homeowner after Breakeven Point	Gross Profit over Mortgage Term (Energy Savings Minus Mortgage Costs)
R-13+5 Walls	$2,358	$277/year ($23/ month)	$472 (plus $9/month)	**33 months**	**$169**	**$4,607**
R-20 Walls	$2,440	$271/year ($23/month)	$488 (plus $9/month)	**37 months**	**$159**	**$4,294**

CONCLUSIONS

- As estimated in this analysis, incremental costs for new 2,400 square foot homes built to the 2012 IECC in Dallas total $2,358 to $2,440 per new home.
- Annual energy savings for Dallas homeowners attributable to the 2012 IECC range from $271 to $277, depending on which exterior wall type builders select.
- Assuming a conservative 20% down payment, new home buyers will break even on their initial investment in as few as 33 months and no more than 3 years and one month after purchase.
- Gross profit for Dallas homebuyers over a 30 year mortgage term ranges from $4,294 to $4,607.

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. BCAP is a project of the Alliance to Save Energy, a nonprofit organization that promotes energy efficiency worldwide through research, education, and advocacy.

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