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Salt Lake City 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 savings of $29 - $30 each month, more than three times incremental mortgage payment.**
- **Break-even on additional down payment and incremental mortgage payment in 17 – 22 months.**
- **Energy cost savings are estimated at between $347 and $361 per year, depending on the exterior wall type used by builders.**
- **2012 IECC home owners pocket $6,926 - $7,800 in net profits over mortgage term.**

SUMMARY

Salt Lake City residents buying new single family homes meeting the 2012 International Energy Conservation Code (IECC) will pocket between $6,926 to $7,800 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.

The energy savings from the 2012 code are enough to pay back the buyer's additional down payment and incremental mortgage cost in approximately 17 to 22 months (*sooner if the homebuyer puts less than 20% down*). **After that date, the owner continues to pocket between $245 and $273 in estimated profit 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.

This report assesses energy savings and incremental construction costs of new, 2,400 square foot single family homes in Salt Lake City that meet the latest model energy code, the 2012 IECC, compared to the current code in effect, the 2006 IECC. Specifically, this analysis finds an average new home meeting the 2012 IECC will cost an additional $1,926 to $2,215 over the construction costs of meeting the current energy code. Energy cost savings are estimated at between $347 and $361 per year, depending on the exterior wall type used by builders.

Stated differently**, monthly utility bill savings to the homeowner 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.**

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 Salt Lake City. The home modeled is two stories in height, with exterior dimensions of 30 by 40 feet with wood-framed walls and a full basement foundation. This size and foundation type is based on regional construction practices. The home size modeled is 2,400 square feet—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 2006 IECC, which is the city's current code. Although some leading builders are already 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 2006 IECC. Also, although we err on the side of good building practice, in an effort to be conservative we have included some incremental costs that may not be necessary. For instance, although it is a good building practice for builders to install conventional "hard ducted" return air ducts, some builders may be using joist cavities (panned floor or enclosed interior wall cavities) in lieu of conventional "hard ducted," metal or other return ducts. In an effort to anticipate this possible cost (and others) for some builders, we include the incremental costs of upgrading to hard ducted return ducts, which are required in the 2012 IECC.

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 2006 IECC, according to the prescriptive requirements in the 2012 IECC. These changes include increased ceiling insulation from R-38 to R-49 blown-in insulation, a window upgrade to meet a lower U-factor, improved house air sealing and testing, insulating hot water pipes, increasing the percentage of compact florescent bulbs in hard-wired fixtures from 0 to 75 percent, a bathroom vent fan upgrade, upgrading from panned to "hard ducted" return ducts, sealing and insulating the attic hatch, and upgrading to programmable thermostats. Additionally, meeting the latest code will require an upgrade of basement insulation from R-10 to R-15.

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 2006 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

To estimate incremental costs, we rely on construction costs from the well-regarded *2011 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]

Attic Insulation

Among other changes, the 2012 IECC requires builders to upgrade blown-in ceiling (attic) insulation from R-38 to R-49, which is estimated by RS Means to cost an additional $399 per new home. Builders will also need to make window upgrades to meet the 2012 IECC. To meet the improved U- factors for the 2012 IECC (.32 from .35). This added cost is conservatively 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

[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 is 81%, indicating that construction costs in Salt Lake City are approximately 19% lower than the national average.

already install windows that already meet the 2012 IECC 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

Additionally, we estimate that the additional required air sealing in the 2012 IECC and the required whole house air leakage (commonly known as "blower door") and duct leakage testing will add about $350 per new home.[3] Because the resulting home will have fewer air and duct leaks to the outside, 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 an automatic control 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. Builders will also have to install high-efficiency lights in 75 percent of hard-wired fixtures, up from 10 percent in the 2006 IECC. Usually, this requirement is met with compact florescent lights (CFLs). Our analysis estimates that the upgrade of 75 percent of fixtures will cost no more than $50. Builders will also have to upgrade conventional thermostats to programmable thermostats, a cost which is estimated as $50.

Sealing and Insulate Attic Hatch

To meet the 2012 IECC we also estimate an additional $100 to seal and insulate the attic hatch. This cost varies 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, or simple hatch. 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, builders can place a variety of kits over stair hatch, but costs are higher. Prior analysis for pull-down stair insulation and sealing completed in conjunction with the Home Builders Association (HBA) 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.

Hard Ducted Returns

For builders that are currently using "panned" floor joists as return air ducts, meeting the 2012 IECC will require an upgrade to conventional "hard ducted" returns in basement ceilings. Many builders already use conventional ducts as returns, but this cost has been included in this analysis regardless. Calculating the cost change between panned and conventional ducts is challenging, as panned ducts are not priced in RS Means and many construction cost sources. After consulting with HVAC contractors, who indicated the

[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.

cost of panned ducts was roughly half of conventional ducts, incremental costs are estimated in this analysis as one-half of cost of flexible return ducts. We believe this cost is reasonable due to the significant amount of labor required for panned ducts, as contractors must screw sheet metal between two adjacent joists and seal the edges with mastic. RS Means estimates the installed cost of flexible, non-insulated, 6" diameter flexible ducts at $4.58 per linear foot.[6] As such, the cost to upgrade ducts is estimated at $2.29 per linear foot, or $139 for the estimated 75 feet of return duct which some builders will have to upgrade under the 2012 IECC.

Interior Basement Insulation

Additionally, many builders will have to upgrade the interior basement insulation. According to local building experts, most builders currently meet the 2009 IECC by installing basement wall fiberglass batt insulation to the inside of basement walls. To meet the 2012 code, these builders will have to upgrade from R-10 to R-15 batts. R-15 Hanging batts are not priced in RS Means and calls to local building suppliers yielded only the cost R-19 hanging insulation, which is priced at an additional $0.18 per square foot. Although the R-15 insulation should be less expensive than the quoted R-19, the $0.18 cost per square foot is used in this analysis, which adds $202 in incremental costs.

Exterior Walls

Finally, some builders may have to make a small upgrade to exterior walls. The 2006 IECC requires new home walls to meet R-19 or R-13+5, while the 2012 IECC requires either R-20 or R-13+5. For builders who already build R13+5 walls, the code does not require a change, and these builders will not incur any additional incremental costs. However, for builders currently meeting the 2006 code with R-19 walls (a 2 x 6 framed wall with R-19 fiberglass batts) they will have to upgrade batt insulation slightly, to an R-20 high density fiberglass batt, a cost which is estimated by RS Means as 15 cents per square foot of wall area. This cost, as well as all other estimated incremental costs are summarized in a **Table 1**, below.

Table 1: Salt Lake City 2012 IECC Incremental Costs

Building Component	Total Area	Incremental Cost/Square Ft	Total	Location Factor	Adjusted Total
Ceiling Insulation Upgrade from R-38 to R-49 (both blown-in)	1,200	$0.41	$ 492.00	81%	$399
1st Floor Panned Return Ducts Upgraded to Flexible Ducts	75 linear ft	$2.29/lf	$ 171.75	81%	$139
Basement Wall Insulation Upgrade from R-10 to R-15 (R-19)	1,120	$0.18	$ 201.60	N/A	$202
Upgrade Windows from U-.35 to U-.32	357	$1.00	$ 357.00	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	N/A	N/A	N/A	N/A	$ 50
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
Sealing/Insulating Attic Hatch	N/A	N/A	N/A	N/A	$100
Upgrade R-19 walls to R-20 with high density fiberglass batts (R-13+5 walls exempted from this cost)	2,380	$0.15	$357	81%	$289
Incremental Cost (R-13+5 Walls) $1,926 OR					
Incremental Cost (2 x 6 Walls - includes R-19 to R-20 insulation cost)				**$2,215**	

[6] Less expensive duct options are available, but this product matches the modeling assumptions used by ICFI.

ENERGY COST SAVINGS

According to the model used in this analysis, **upgrading to the 2012 IECC will result in significant energy cost savings for Salt Lake City homeowners , resulting in savings of between $347 and $361 per year,** depending on the type of exterior wall type builders select. In energy modeling simulations, R13+5 walls perform slightly better than R-20 walls, saving an additional $14 per year. 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.

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 $347 and $361 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 approximately 17 to 22 months (or sooner if the loan allows a down payment below 20%). After that date, the owner continues to realize a profit of at least $245 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 $385 to $443 with an additional mortgage cost of $7 or $8 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 17 months. After that break-even date, **homeowners would continue to save between $245 and $273 annually,** after additional mortgage costs are subtracted 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 2, below.

Table 2: 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
R-13+5 Walls	$1,926	$361/year ($30/month)	$385 (plus $7/month)	**17 months**	**$273**
R-20 Walls, Studs 16" on center	$2,215	$347/year ($29/month)	$443 (plus $8/month)	**22 months**	**$245**

CONCLUSIONS

- As estimated in this analysis, incremental costs for new 2,400 square foot homes built to the 2012 IECC in Salt Lake City total $1,926 to $2,215 per new home.
- Annual energy savings for Salt Lake City homeowners attributable to the 2012 IECC range from $347 to $361, 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 17 months and no more than 22 months after purchase.

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.

Contact Information:

2012 IECC Adoption and Energy Codes Policy

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

Jeffrey Harris
Senior Vice President - Programs
Alliance to Save Energy
(202) 530-2243
jharris@ase.org

Technical Analysis

John Miller
Senior Research Associate
Building Codes Assistance Project
(202) 530-4340 (direct)
jmiller@ase.org

Mike DeWein
Technical Director
Building Codes Assistance Project
(518) 664-1308 (direct)
mdewein@ase.org