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Arizona 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 to be $185-$418 per year ($15-$35 per month), when compared to homes meeting the 2006 IECC, the energy code currently in place in most Arizona jurisdictions.**
- **Break-even on the investment in greater efficiency —the added down payment and a slight mortgage payment increase — occurs in as little as seven months.**
- **After the break-even point, homeowners achieve a net profit (energy cost reductions less outlays for efficiency improvements) of $100-$317 annually.**
- **2012 IECC homebuyers pocket $2,642 and $9,233 in net profits over the length of a 30 year mortgage term.**

SUMMARY

Arizona residents buying new single family homes meeting the 2012 International Energy Conservation Code (IECC) will pocket between $2,642 and $9,233 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 Arizona that meet the latest model energy code, the 2012 IECC, compared to the current assumed baseline, the 2006 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 $798 to $2,870 as compared to the costs of homes meeting the current baseline. **Annual energy savings for 2012 IECC homes are significant, and are estimated in this study at between $185 and $418 per year.**

The energy savings from the 2012 code are enough to pay back the buyer's additional down payment and slightly increased mortgage cost in as soon as seven 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 $100 and $317 annually, depending on foundation and wall type—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 no less than twice 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 Arizona. For this analysis, we modeled a two story home, with exterior dimensions of 30 by 40 feet, wood-framed walls, and a 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.

Because Arizona has no statewide energy code, for the purposes of this analysis we assume a baseline home that meets the requirements of the 2006 IECC. Although some leading builders are meeting or exceeding many elements of this code already, for the purposes of this analysis we assume a baseline home that exactly meets the requirements of the 2006 IECC.

Energy savings for each of Arizona's four climate zones 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 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 SHARED BY ARIZONA CLIMATE ZONES 2-5

Incremental construction costs vary between Arizona's four climate zones, as each climate zone is carefully drawn to respond to dramatic differences in climate throughout the state. However, new homes throughout the state share many 2012-triggered incremental costs in common, which are presented in this section and followed in subsequent sections by costs unique to each climate zone.

Incremental costs were calculated using the 2,400 square foot model home as a baseline, and by identifying the building components that would have to be upgraded from the 2006 IECC, according to the prescriptive requirements in the

Figure 1: Slab on Grade Foundation. Credit flickr user US Forest Service

2012 IECC. 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.

Lighting and Programmable Thermostats

Builders will have to install high-efficiency lamps in 75 percent of hard-wired fixtures, up from 0 percent in the 2006 IECC. Usually, this requirement is met with compact florescent lights (CFLs). Our analysis estimates that the upgrade of lamps in 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.

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

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]

Sealing and Insulating Attic Hatch

As well, 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.

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[1] RS Means also includes a location factor, which provides an estimate of local costs as a percentage of RS Means national average estimates. In an effort to be conservative this analysis uses the highest location factor statewide, which for Arizona is Phoenix. The location factor for Phoenix is 86%, indicating that construction costs in the Richmond are approximately 14% lower than the national average.

[2] 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.

[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.

Attic Insulation
The 2012 IECC also requires builders to upgrade blown-in ceiling (attic) insulation. In climate zones 2 and 3, insulation is upgraded from from R-30 to R-38, which is estimated by RS Means to cost an additional $248 per new home. In climate zones 4 and 5, insulation must be upgraded from R-38 to R-49, an increase in cost of $351 per new home.

Windows
Windows in all the state's climate zones will also have to be upgraded to meet the 2012 IECC. In climate zone 2, window U-factor and SHGC factors are upgraded to 0.40 and 0.25, respectively. To meet these requirements, the Efficient Windows Collaborative (EWC) conservatively estimates incremental costs as no more than $1.50 per square foot of window area.[5] Total window incremental costs are therefore estimated to be $536 for new homes in climate zone 2. For climate zone 3, where U and SHGC factors are upgraded to 0.35 and 0.25, respectively, EWC likewise estimates an incremental cost of $1.50 per square foot of window area, totaling $536 per new home. In climate zone 4, incremental costs are estimated at $0.50 per square foot of window, totaling $179 per new home. Finally, in climate zone 5, incremental costs are estimated at $1 per square foot of window area, for a total of $357 per new home.

INCREMENTAL COSTS FOR CLIMATE ZONE 2

Arizona's climate zone 2 contains many of the state's largest and fastest-growing communities, including the capital, Phoenix, and is made up of La Paz, Maricopa, Pima, Pinal, and Yuma counties.

As described in the proceeding section, Arizona's climate zone 2 shares many incremental costs with the remainder of the state. These include attic insulation upgrades expected to total $248 per new home, and estimated incremental windows costs of $1.50 per square foot.

Cost Savings
Fortunately for Arizona builders, these strengthened energy provisions will 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 Arizona's climate zone 2 with a slab foundation, energy modeling indicated builders will be able to reduce the cooling system capacity by an average of 1.43 tons. Because HVAC systems are sold in one half ton increments, this anticipated reduction is rounded down to 1 ton in an effort to be conservative. This reduction in air conditioner capacity should result in savings of approximately $815 for the average new house.[6] Total incremental costs for new homes in Arizona's climate zone 2 are estimated in table 1, below:

[5] It is important to note that many builders may 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. As a result, many builders will be able to reduce or avoid incremental costs for better windows.

[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. 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.

Table 1: 2012 IECC Incremental Costs in Arizona Climate Zone 2					
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	$0.24	$ 288	86%	$ 248
Upgrade window U factor to 0.40, SHGC to 0.25	357	$1.50	$ 536	N/A	$ 536
Air Sealing and Testing	N/A	N/A	N/A	N/A	$ 350
Upgrade to Programmable Thermostats	N/A	N/A	N/A	N/A	$ 50
Insulating Hot Water Pipes	N/A	N/A	N/A	N/A	$ 100
75% CFLs in hardwired fixtures (from 0%)	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
HVAC System Savings (downsizing cooling system 1 ton)					$ (815)
Incremental Cost					**$ 798**

INCREMENTAL COSTS FOR CLIMATE ZONE 3

Arizona's climate zone 3 encompasses Cochise, Graham, Greenlee, Mohave, and Santa Cruz counties. In addition to changes shared statewide, builders in these counties will have to make upgrades to the exterior walls of new homes.

Exterior Walls

The 2012 IECC would require builders to make changes to a new home's exterior wall construction. At present, the 2006 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)[7]—an engineered product that combines structural reinforcement of oriented strand board (OSB) with insulation equivalent to R-5, thus creating an R-13+5 wall.[8] 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 2006 IECC. This cost is estimated by RS Means as $0.68 per square foot of wall area, for a total of $1,618 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

[7] 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.

[8] 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

wall that increases the space between wall studs from 16 inches apart to 24 inches known as O.V.E. framing—thus saving lumber and dramatically reducing incremental cost. With studs spaced 24 inches on center, the cost of upgrading the model home's walls for the 2012 IECC drops to $928. In order to be conservative, O.V.E. framing costs are not included in this report, but this technique presents an opportunity for savvy builders to lower cost.

Window Extension Jambs

Builders in Arizona 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.

Cost Savings

As in climate zone 2, builders will be able to reduce the cost of cooling equipment due to the improved building envelope. Building modeling indicates that right-sizing the cooling equipment for the model home in climate zone 3 would allow builders to lower system size by 1.5 tons, which yields $1,223 in construction cost savings per new home. Total incremental costs for new homes in Arizona's climate zone 3 are estimated in table 2, below:

Table 2: 2012 IECC Incremental Costs in Arizona Climate Zone 3

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	$0.24	$ 288	86%	$ 248	
Upgrade window U factor to 0.35, SHGC to 0.25	357	$1.50	$ 536	N/A	$ 536	
Air Sealing and Testing	N/A	N/A	N/A	N/A	$ 350	
Upgrade to Programmable Thermostats	N/A	N/A	N/A	N/A	$ 50	
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	
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	
Wall Option 1: R13+5 Walls	2,380	$0.76	$1,813	N/A	$1,813	**OR**
Wall Option 2: R-20 Walls	2,380	$0.68	$1,618	N/A	$1,618	
Window Extension Jambs: *Applicable only to R-20 Walls, above*	N/A	N/A	N/A	N/A	$ 300	
HVAC System Savings (downsizing cooling system 1.5 tons)					$ (1,223)	
Incremental Cost (R-13+5 Walls)						**$2,203**
Incremental Cost (R-20 Walls)						**$2,309**

INCREMENTAL COSTS FOR CLIMATE ZONE 4

Arizona's climate zone 4 encompasses Gila and Yavapai counties. For attics, insulation increases from R-38 to R-49, and builders once again have the option of installing R-13+5 or R-20 walls.

Exterior Walls
As in climate zone 3, the 2012 IECC would require builders to make changes to a new home's exterior wall construction. At present, the 2006 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)—an engineered product that combines structural reinforcement of oriented strand board (OSB) with insulation equivalent to R-5, thus creating an R-13+5 wall. 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 2006 IECC. This cost is estimated by RS Means as $0.68 per square foot of wall area, for a total of $1,618 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 known as O.V.E. framing—thus saving lumber and dramatically reducing incremental cost. With studs spaced 24 inches on center, the cost of upgrading the model home's walls for the 2012 IECC drops to $928. In order to be conservative, O.V.E. framing costs are not included in this report, but this technique presents an opportunity for savvy builders to lower cost.

Window Extension Jambs
Builders in Arizona 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.

Cost Savings
As in climate zones 2 and 3, builders will be able to reduce the cost of cooling equipment due to the improved building envelope. Building modeling indicates that right-sizing the cooling equipment for the model home in climate zone 4 would allow builders to lower system size by one half ton, which yields $408 in construction cost savings per new home.

Total incremental costs for new homes in Arizona's climate zone 4 are estimated in table 3, below:

Table 3: 2012 IECC Incremental Costs in Arizona Climate Zone 4						
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	$0.34	$ 408	86%	$ 351	
Upgrade window U factor to 0.35, SHGC to 0.40	357	$0.50	$ 179	N/A	$ 179	
Air Sealing and Testing	N/A	N/A	N/A	N/A	$ 350	
Upgrade to Programmable Thermostats	N/A	N/A	N/A	N/A	$ 50	
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	
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	
Wall Option 1: R13+5 Walls	2,380	$0.76	$1,813	N/A	$1,813	**OR**
Wall Option 2: R-20 Walls	2,380	$0.68	$1,618	N/A	$1,618	
Window Extension Jambs: *Applicable only to R-20 Walls, above*	N/A	N/A	N/A	N/A	$ 300	
HVAC System Savings (downsizing cooling system one half ton)					$ (408)	
Incremental Cost (R-13+5 Walls)						**$2,764**
Incremental Cost (R-20 Walls)						**$2,870**

INCREMENTAL COSTS FOR CLIMATE ZONE 5

Arizona's climate zone 5 includes Apache, Coconino, and Navajo counties, which together make up the northeast corner of the state. Compared to other areas of the state, the incremental costs and energy savings from the 2012 are relatively lower. In addition to those costs incurred in all climate zones throughout the state, climate zone 5 is noteworthy for a slight change some builders may have to make to exterior walls. Because the region's cooling needs are not as high as other climate zones, this climate zone is also unique because builders are not expected to realize cost savings via cooling equipment "right-sizing."

Exterior Walls

Under the 2006 IECC, builders are required to use R-19 or R-13+5 walls, while updates in the 2012 IECC provides a choice between R-13+5 and R-20 walls. Thus, for builders currently using R-13+5 walls, no changes will be required. For builders currently using conventional R-19 batts in 2 x 6 walls, they will have to make a slight upgrade to a higher density R-21 fiberglass batt, which is estimated by RS Means to add no more than $0.13 per square foot of wall area. In order to present a conservative cost for meeting the prescriptive 2012 code requirements, this additional cost is included in table 4, below, which summarizes incremental costs for Arizona's climate zone 5:

Table 4: 2012 IECC Incremental Costs in Arizona Climate Zone 5					
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	$0.34	$ 408	86%	$ 351
Upgrade window U factor to 0.32	357	$1.00	$ 357	N/A	$ 357
Air Sealing and Testing	N/A	N/A	N/A	N/A	$ 350
Upgrade to Programmable Thermostats	N/A	N/A	N/A	N/A	$ 50
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
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
Exterior Walls* Upgrade exterior walls from R-19 to R-20	2,380	$0.13	$309	N/A	$ 309
Incremental Cost (R-19 Wall Baseline)					**$1,847**

***Note: exterior wall upgrades will not be required for all builders in climate zone 5**

ENERGY COST SAVINGS

According to the model used in this analysis, **upgrading to the 2012 IECC will result in significant energy bill savings for Arizona homebuyers, resulting in utility bill savings of between $185 and $418 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. These energy savings allow homebuyers to quickly recapture their incremental costs. Energy cost savings are presented below in table 5 for each climate zone and wall type modeled:

Table 5: 2012 IECC Energy Savings for 2012 IECC Homes in Arizona	
Climate Zone and Wall Types	**Annual Energy Savings**
Climate Zone 2	$350
Climate Zone 3, *R-13+5 Walls*	$418
Climate Zone 3, *R-20 Walls*	$399
Climate Zone 4, *R-13+5 Walls*	$301
Climate Zone 4, *R-20 Walls*	$273
Climate Zone 5, *R-19 Wall Baseline* (upgraded to R-20 under 2012 IECC)	$185

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 $185 and $418 per year, monthly utility bill savings are between two and nine times 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 within as soon as seven 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 up to $317 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 $160 and $574 with an additional monthly mortgage cost of between $3 and $11 per month. Taking into account energy savings and lower utility bills, a cash flow analysis indicates that the homebuyer would break even within as soon as seven months after purchase. After that break-even date, **homeowners would continue to realize a profit of up to $317 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 6, below.

Table 6: Mortgage Payback for Homeowners of 2012 IECC Homes in Arizona

Home 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)
Climate Zone 2	$ 798	$350/year ($29 per month)	$160 (plus $3/month)	7 months	$313	$9,233
Climate Zone 3, R-13+5 Walls	$2,203	$418/year ($35 month)	$441 (plus $8/month)	1 year and 5 months	$317	$9,075
Climate Zone 3, R-20 Walls	$2,309	$399/year ($33/month)	$293 (plus $9/month)	1 year and 7 months	$293	$8,344
Climate Zone 4, R-13+5 Walls	$2,764	$301/year ($25/month)	$553 (plus $11/month)	3 years and 2 months	$173	$4,662
Climate Zone 4, R-20 Walls	$2,870	$273/year ($23/month)	$574 (plus $11/month)	4 years	$141	$3,681
Climate Zone 5, *Assumed R-19 Baseline*	$1,847	$185/year ($15 month)	$369 (plus $7/month)	3 years and 8 months	$100	$2,642

CONCLUSIONS

- As estimated in this analysis, incremental costs for new 2,400 square foot homes built to the 2012 IECC in Arizona range from $798 to $2,870 per new home, depending on climate zone and exterior wall type.
- Annual energy savings for Arizona homeowners attributable to the 2012 IECC range from $185 to $418 per year.
- Assuming a conservative 20% down payment, new home buyers will break even on their initial investment in as little as seven months after purchase.
- Gross profit for homebuyers over a 30 year mortgage term ranges from $2,642 to $9,233.

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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