



September 30, 2009

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RE: 2009 International Energy Conservation Code Incremental Cost Report  
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**Approach:** This letter discusses cost impacts associated with upgrading the Nebraska State Energy Code from the current 2003 International Energy Conservation Code (IECC) to the 2009 IECC. It is based directly on our recently completed report: *Energy Impact Study of the 2003 IECC and 2009 IECC Energy Codes for Nebraska*. This report focused on the energy use impact of updating Nebraska's residential energy code.

The item-by-item differences between the 2003 and 2009 codes and the cost impact of each are discussed below. An important difference between the codes is that the 2003 code divides the state into three distinct climate zones (represented by Omaha, Norfolk and Chadron) with different requirements, while the 2009 code has uniform requirements throughout the state. Also, the 2003 code requires higher levels of insulation for homes with more windows, while the 2009 code does not. Therefore, the 2009 code has more uniform requirements and may be easier to implement for builders who cover multiple cities or use varying window percentages.

Cost estimates were obtained from three sources:

- RSMMeans Cost works online – Residential edition, 2009 data for residential new construction in Omaha, NE.
- EPA report: “Energy Star Qualified Homes 2011 Savings and Cost Estimate Summary” available online at:  
[http://www.energystar.gov/ia/partners/bldrs\\_lenders\\_raters/downloads/2011\\_Savings\\_Cost\\_Summary.pdf](http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/2011_Savings_Cost_Summary.pdf)
- Home Depot web site – provides online pricing available to customers nationwide. Online pricing often mirrors pricing available in national chain home improvement stores.



### **Exterior wall insulation:**

The **2009 IECC** requires either R-20 exterior walls or R-13+5. R-20 can be achieved with an R-21 batt in a 2x6 exterior wall. R-13+5 means that a 2x4 wall with R-13 (such as a fiberglass batt) is combined with an exterior insulated sheathing product having an R-value of 5 that covers at least 75% of the exterior wall. Therefore, the 2009 IECC requirements can be met statewide using either of these methods.

The **2003 IECC** requires R-21 or higher for all homes in the Norfolk and Chadron climate zones. This essentially requires a 2x6 wall to be used. The 2003 code allows homes in Omaha with under 15% window to wall ratio to be constructed with R-18 walls. This can be accomplished using either a 2x4 wall with an R-13 batt plus R-5 exterior insulation or using a 2x6 wall with R-19 fiberglass batts.

**Net change:** The 2009 code allows all homes in the state to be constructed using a minimum of 2x4 walls with R-13 fiberglass batts with R-5 insulated sheathing. This is the same as the least stringent requirement throughout the state under the 2003 code. The construction cost does not change for homes in Omaha with under 15% window to wall ratio, and could be lower for all other homes in the state.

**Cost example:** For the 1852 sf ranch home in the energy study (with 2000 sf exterior wall area), RSMMeans installed costs including Overhead and Profit (O+P) are as follows: \$4,326 for 2x4 framing, R-13 fiberglass batts, and R-5.4 isocyanurate rigid insulation OR \$5,082 for 2x6 framing, R-21 fiberglass batts, and 1/2 inch OSB exterior sheathing. For homes that would have required R-21 exterior walls under the 2003 IECC, there would be a potential \$756 construction cost savings under the 2009 IECC.

### **Basement wall insulation:**

The **2009 IECC** requires either R-10 continuous basement wall insulation or R-13 insulation in a framed cavity. R-10 continuous insulation could be achieved using a rigid board product on the interior or exterior of the wall. R-13 cavity insulation is most often obtained using R-13 fiberglass batts in a 2x4 cavity.

The **2003 IECC** requires between R-10 and R-15 basement wall insulation. The Omaha requirement is R-10 and most other homes in the state require R-11. This could be met using an R-11 batt in a 2x4 framed cavity.

**Net change:** If continuous rigid board insulation is used, the 2009 IECC allows homes across the state to use the current minimum statewide insulation level under the 2003 IECC. Therefore there would be no cost increase and there could be a construction cost savings in some areas. If framed cavity insulation is used, both codes can be met using a 2x4 wall. Most homes in the state would need to upgrade from R-11 to R-13 fiberglass batts.

**Cost example:** RSMMeans cost data list exactly the same installed cost for R-11 and R-13 fiberglass batts (\$0.58 per sf). Both types of batt have the same thickness and do not require different framing methods. Therefore, there is no change in cost for most homes built in the state. Where R-15 insulation was required under the 2003 IECC, there would be a construction cost reduction from \$0.65 to \$0.58 per square foot. For the 1852 sf ranch (with 1600 sf of basement wall), this would be a savings of \$112.



### **Ceiling insulation:**

The **2009 IECC** requires R-38 insulation in ceilings state-wide. This can be accomplished using R-38 fiberglass batts (10” to 12” thick) or with blown-in insulation. The **2003 IECC** requires R-49 insulation in most ceilings throughout the state. R-38 ceilings are allowed for homes in the Omaha climate zones with less than 15% window to wall ratio. R-49 insulation can be accomplished with blown-in insulation or with a combination of batts and blown-in insulation.

**Net change:** For homes in Omaha with less than 15% window to wall ratio, there is no change. All other homes in the state would see a construction cost savings under the 2009 IECC as the insulation is reduced from R-49 to R-38.

**Cost example:** The 1852 sf ranch home has 1852 sf ceiling area. Using RSMMeans cost data for blown fiberglass attic insulation, the installed cost including O+P is \$2,883 for R-38 insulation and \$3,622 for R-49. This would be a \$739 construction cost savings for most homes built in the state.

### **Floor insulation:**

The **2009 IECC** requires R-30 insulation for all floors over unconditioned spaces – including garages, cantilevered floors and floors over unconditioned basements or crawlspaces. This can be met using a 9” fiberglass batt in a 2x10 floor cavity. The code also allows less than R-30 to be used if it fills the entire floor cavity, so the only construction cost increase is for the insulation itself – no changes to the structure are required to accommodate increased insulation.

The **2003 IECC** requires between R-19 and R-30 insulation depending on the location and window to wall ratio. Most homes currently being built in Nebraska require R-21 floor insulation. This can be accomplished using a 5.5” R-21 fiberglass batt.

**Net change:** Because the code does not require structural upgrades to accommodate additional insulation, the only added construction cost is for the insulation itself. The 2009 IECC would require most homes with insulated floors to upgrade from an R-21 floor to an R-30 floor. However, most homes in Nebraska are constructed with conditioned basements and have very little insulated floor area. Therefore, the statewide impact of this change is likely to be minimal.

**Cost example:** The 1852 sf home used in the energy study has no floors over unconditioned space since it was modeled with a conditioned basement having insulation on the walls. If the home had an unconditioned basement, it would have 1852 sf of floor area. RSMMeans cost data does not provide pricing for R-21 batts in floors, but it would be only incrementally higher than the cost for R-19 batts in floors. The cost to install R-19 insulation in this home’s floor would be \$1,996, and the cost to install R-30 insulation in the floor would be \$2,495. Therefore, homes that had unconditioned basements would experience an added construction cost of \$499. In this case, the walls of the basement would not also need to be insulated, saving approximately \$0.58 per square foot of basement wall.



**Programmable thermostats:**

The **2009 IECC** requires programmable thermostats be installed for all homes having furnaces, but does not require them for homes with heat pumps.

The **2003 IECC** has no requirement for programmable thermostats.

**Net change:** All homes with furnaces would need to install a programmable thermostat under the 2009 code.

**Cost example:** RSMMeans cost data lists installed costs for non-programmable thermostats as \$71.41 and for programmable thermostats as \$145.69. RSMMeans uses the same labor cost for the two types – the only difference in their listed cost is for materials. RSMMeans indicates a \$26.92 material cost for non-programmable and \$94.72 for programmable. These numbers do not seem to match widely available prices in the marketplace. The Home Depot web site lists non-programmable thermostats ranging from \$8.97 to \$29.98 and programmable thermostats that would meet the code requirement ranging from \$19.98 to \$99.99. However, most of the more expensive models are designed to work with heat pumps, and the new code does NOT require programmable thermostats to be used with heat pumps. The 2011 Energy Star qualified homes cost estimate includes an estimated premium of \$19.00 for programmable thermostats. Based on marketplace prices, I feel that the Energy Star estimate is accurate.

**Energy efficient lighting:**

The **2009 IECC** requires that high-efficacy lighting be used for 50% of installed lamps. The least expensive means of meeting this requirement is to use screw-base replacement compact fluorescent (CFL) light bulbs.

The **2003 IECC** has no requirement for high-efficacy lighting.

**Net change:** The 2009 code would require CFL bulbs to be installed in 50% of the home.

**Cost example:** A home with eight rooms, having an average of three light bulbs installed per room would be delivered with 24 total lamps. RSMMeans does not list cost data for lamps. The Home Depot web site lists a cost of \$35.89 for a package of 120 60-Watt incandescent lamps and a cost of \$149.82 for a package of 72 13-Watt (60 Watt light output equivalent) compact fluorescent lamps. This is a cost difference of \$1.78 each. To replace twelve lamps, the total increased cost would be less than \$22.

**Duct sealing and testing:**

The **2009 IECC** has requirements for duct leakage that can be met/demonstrated in one of four ways: (1) Postconstruction duct blaster testing demonstrating leakage to outdoors of less than 8 cfm/100 sf of conditioned floor area; (2) Rough-in duct blaster testing demonstrating total duct leakage less than 6 cfm/100 sf of conditioned floor area performed with the air handler installed; (3) Rough-in duct blaster testing demonstrating total duct leakage less than 4 cfm/100 sf of conditioned floor area performed without the air handler installed; or (4) no testing is required if the air handler and all ducts are located inside conditioned space.

The **2003 IECC** requires duct sealing, but has no testing requirement, thus the requirement has been largely unenforced.



**Net change:** Many homes in Nebraska have all or part of the HVAC system located inside conditioned space. When this is the case, there is no cost increase associated with this requirement. For homes with systems installed outside conditioned space, there may be cost increases associated with properly air sealing ductwork. A duct blaster test will also be required.

**Cost example:** RSMMeans does not list costs for duct sealing and testing. However, this has been addressed in the Energy Star 2011 Cost Estimate. That report estimates an additional cost of \$100 per 1000 sf of conditioned space for duct sealing and testing to meet a similar airtightness requirement. For the 1852 sf ranch home, this would add \$185 in additional cost.

**Air sealing and testing:**

The **2009 IECC** contains new requirements for air leakage and air sealing. The air sealing items are similar to those required by the current Energy Star thermal bypass checklist. There are two ways to meet the requirement: (1) testing – perform a blower door test and obtain results of less than 7 air changes per hour when tested at 50 Pa pressure. Or (2) using a checklist to perform a visual inspection to verify air sealing and the presence of air barriers, performed by a code official or approved third party independent of the installer of the insulation.

The **2003 IECC** does not include an air sealing or testing requirement.

**Net change:** Homes would have to demonstrate airtightness using either a blower door test or through the use of a checklist of air sealing items.

**Cost example:** RSMMeans does not list costs for blower door testing or air sealing. However, the Energy Star 2011 Cost Estimate report does list a cost of \$250 to comply with the current thermal bypass checklist. This cost includes materials and labor to meet the checklist and third party verification of the items. The cost to instead perform blower door testing would likely be similar.

**Summary:**

The table below summarizes expected cost changes for the 1,852 sf ranch-style house.

Code Change	Construction Cost Change	Notes
Exterior walls	\$0 to -\$756	\$0 for Omaha homes with 15% window to wall ratio
Basement walls	\$0 to -\$112	\$0 for all homes except Chadron 18% window to wall ratio
Ceiling	\$0 to -\$739	\$0 for Omaha homes with 15% window to wall ratio
Floor	+\$499	Not applicable to most NE homes – only required if basement unconditioned



Programmable thermostat	+\$19	Required for all homes.
High efficacy lighting	+\$22	Required for all homes.
Duct sealing and testing	+\$185	Required for all homes.
Air sealing and testing	+\$250	Required for all homes.
Estimated total (Omaha, 15% window to wall ratio, conditioned basement)	+\$476	\$476 additional construction cost for 2009 IECC
Estimated total (all cities, 18% window to wall ratio, conditioned basement)	-\$1,019	\$1,019 reduced construction cost for 2009 IECC

As the table above shows, for the example 1852 sf home constructed in Omaha with 15% window to wall ratio and a conditioned basement, the total estimated increase in construction cost is \$476 if the 2009 IECC is adopted. The energy study showed that this same home could expect to experience \$164 in annual energy savings, providing a less than 3 year simple payback for the homeowner. In most other cities, and in Omaha homes with a window to wall ratio greater than 18%, the construction cost for the 2009 IECC is actually lower than for the 2003 IECC. Since the energy study also showed energy savings for those cases, this provides instant payback for the typical homebuyer.

Sincerely,

Amy Musser  
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