# VALUE OF THE INTERNATIONAL RESIDENTIAL CODE TO LOUISIANA

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On November 29, 2005 Governor Kathleen Blanco signed ACT 12 (R.S. 40:1730.22.C) of the First Extraordinary Legislative Session of 2005. This act created the Louisiana State Uniform Construction Code and designated the 2006 International Residential Code (IRC 2006) as the building code for all one- and two-family dwellings. IRC 2006 includes a chapter dedicated to energy efficiency, chapter 11. The purpose of this chapter is to regulate energy efficiency in the design and construction of dwellings.

The IRC 2006 places the United States into 7 different climate zones, of which, 2 are in Louisiana. Each climate zone has specific requirements that must be met. All ceilings, floors, and walls are assigned minimum insulation R-values. These R-values represent the component's resistance to heat transfer. Basically, a material or component with a low R-value, such as a metal pan, will allow heat to pass through it easily, whereas a component with a high R-value, such as an oven mitt, will resist the flow of heat.

The inverse of thermal resistance is thermal conductance, or U-factor. A material that has a low R-value will have a correspondingly high U-factor. In the IRC, fenestration, such as windows, doors, and skylights, are assigned maximum allowable U-factors. This is to minimize heat entering or leaving through these components. Also, windows, glass doors, and skylights are given maximum solar heat gain coefficients (SHGC). The solar heat gain coefficient is a measure of the percentage of solar radiation (heat energy contained within the sun's light) that is allowed to pass through the glass. For example, if you were to stand outside under a piece of glass with a SHGC of 0, it would feel as though you are standing in the direct sunlight. If the glass were replaced with a piece that has a SHGC of 0.5, you would feel cooler, as your body would feel a 50% reduction in the amount of radiant heat being absorbed.

## Cost, Energy and Emissions Savings

In June 2007, the United States Government Accountability Office released a Report to Congressional Addressees titled *Energy Efficiency: Important Challenges Must Be Overcome to Realize Significant Opportunities for Energy Efficiency Improvements in Gulf Coast Reconstruction*[1], which demonstrated the energy and cost savings that could be realized if Louisiana and Mississippi adopted statewide energy conservation codes. Table 1 illustrates the benefits of the energy portion of the IRC as it pertains to homeowners. The US Department of Energy's Pacific Northwest National Laboratory modeled the levels of energy efficiency that could be achieved and compared this to the homes that were being built prior to code adoption.

Table 1. Savings Projected for Hurricane Recovery Housing

| | Annual Energy and Emissions Savings (per House) | | | | | |
|---|---|---|---|---|---|---|
| **Construction Type** | **[1]Annual Cost Savings** | **Energy Savings (kWh)** | **[2]$CO_2$ (Pounds)** | **[2]$SO_2$ (Pounds)** | **[2]$NO_X$ (Pounds)** | **[2]Mercury (Pounds)** |
| Slab-on-grade | $167 | 1,895.57 | 2276.97 | 5.01 | 3.16 | 0.000023 |
| Elevated | $233 | 2,644.72 | 3176.86 | 7.00 | 4.40 | 0.000033 |

These energy savings were then used to determine emissions savings using environmental emission rates from the US EPA's *Emissions & Generation Resource Integrated Database*[2].

Finally, the expected energy and emissions savings throughout the state for a single year, 2016, were calculated. The numbers of buildings included for slab-on-grade and elevated houses were taken from the Louisiana Recovery Authority's 2006 *Initial Quarterly Report*[3]. This information was used to determine overall energy savings that could be realized if the homes destroyed by Hurricanes Katrina and Rita were built to the new standard versus the business-as-usual approach. It was assumed that all of these houses would be rebuilt in 10 years, by 2016. The costs and savings associated with typical houses were found by taking the mean of slab-on-grade and elevated houses. Based on recent U.S. Census Bureau data, a total of 16,000 new homes were being added to the housing stock annually in the areas that were not severely affected by the hurricanes.[4] Basing the energy and emissions savings of this non-recovery growth on typical houses, the savings associated with 10 years of growth were determined. The construction types were then added together to find the overall energy, cost, and emissions that Louisiana should save because of the Louisiana State Uniform Construction Code. This information can be found in the following chart.

Table 2. Annual Energy and Emissions Savings from Code Built Housing by 2016

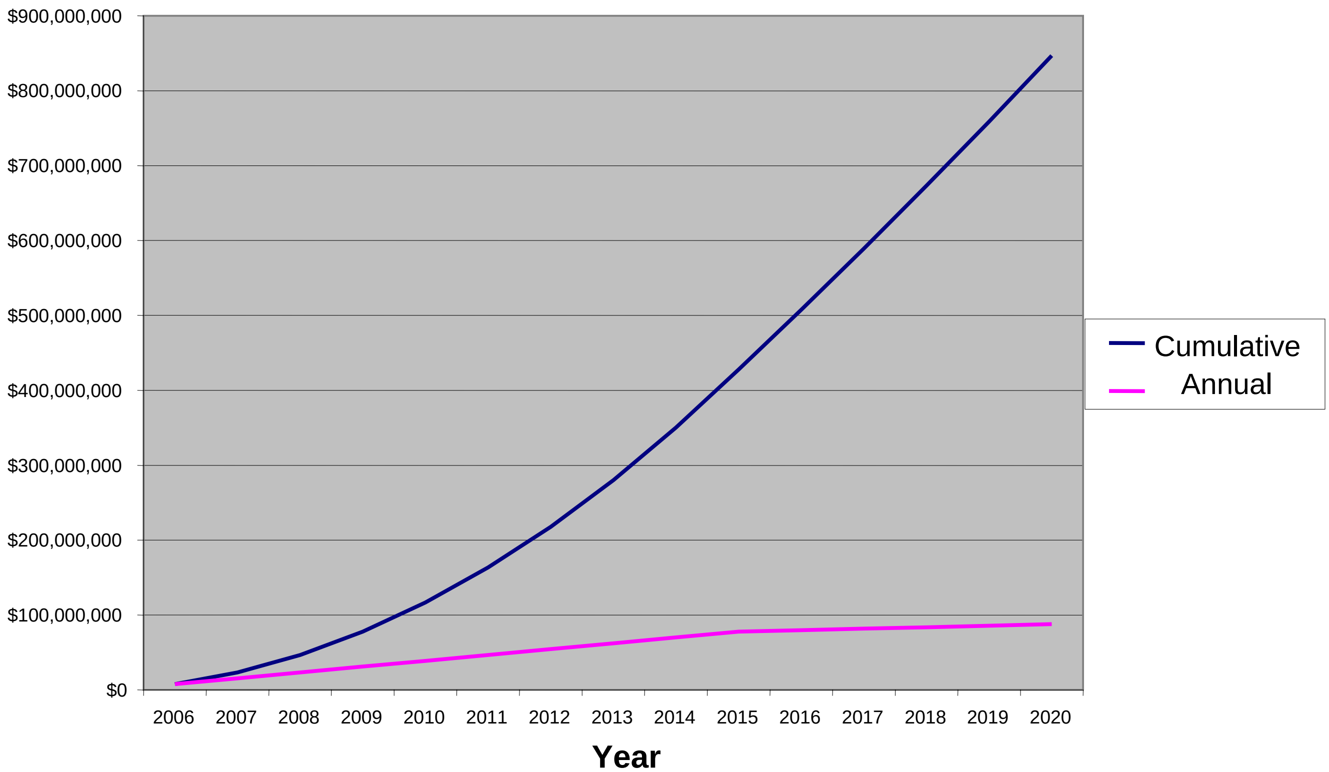
| **Recovery and Non-recovery Housing** | | | **Annual Energy and Emissions Savings Expected Statewide in 2016** | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Construction Type** | **[3]Number of Buildings Affected** | **[1]Annual Savings per Home** | **Total Annual Savings** | **Total Annual Energy Savings (kWh)** | **[2]$CO_2$ (Tons)** | **[2]$SO_2$ (Tons)** | **[2]$NO_X$ (Tons)** | **[2]Mer-cury (lbs)** |
| Slab-on-grade | 65,000 | $167 | $10,855,000 | 123,212,259 | 74,002 | 163.0 | 102.6 | 1.52 |
| Elevated | 150,000 | $233 | $34,950,000 | 396,708,286 | 238,264 | 524.7 | 330.3 | 4.88 |
| Non-Recovery Growth | 160,000 | $200 | $32,000,000 | 363,223,610 | 218,153 | 550.0 | 302.4 | 4.47 |
| Sum of Construction | 375,000 | | $77,805,000 | 883,144,154 | 530,419 | 1,168 | 735.3 | 10.86 |

## It Pays For Itself

The US GAO report determined that the incremental cost increase of building to code versus the business-as-usual approach would be about $618 per house. Using this initial cost increase, the payback period can be determined, as well as a simple cash flow. For slab-on-grade houses, the investment in energy efficiency required by the code would be repaid in energy savings in approximately 3.7 years. For elevated houses, the payback period would be much shorter, about 2.7 years. On average, a payback period of 3.1 years would be reasonable. Projecting these savings over a 30 year period, building to the standards of the code will save $4,392 for slab-on-grade homes and $6,372 for elevated homes. Also, provisions within the energy code help prevent condensation inside of the home, which will ultimately reduce maintenance costs. Looking at the cost savings, the reduction in energy costs will more than pay for the nominal increase in mortgage payments.

The information in the following graph was taken from the chart above. The reconstruction of hurricane damaged houses was spread out across a 10 year period. On top of the reconstruction, an annual housing growth of 16,000 houses was included. Looking at the annual savings, it can be seen that the annual savings increase more rapidly for the first 10 years. This is because of the assumption that the reconstruction will be evenly spaced over that 10 year period.

Figure 1. Graph of Total Energy Cost Savings through 2020




## In Summary

The previous analyses illustrate the benefits of the energy components of the International Residential Code, not only for the state, but for the individual homeowner. The homeowner would immediately begin saving money on his electric bill. The improvements to the construction will continue to reduce consumption. This would generally pay for the costs of the improvements in less than 4 years. It doesn't stop there, though. For the remainder of the house's life, the improvements will continue saving money on monthly energy bills, and, as they say, a penny saved is a penny earned.

For the environmentally-conscious homeowner, the benefits of the energy code are clear. At a time when the country is grappling with growing emissions, building energy codes represent an opportunity to reduce our impact on the environment. Although the amount of emissions saved annually may seem small for a single house, the sheer number of houses ensures that the overall impact is great. If we, as a state, want to continue living with an improved quality of life, we must begin investing in our future. This means doing everything that we can to ensure a solid economy and clean environment. Overall, the savings and environmental benefits of building to the code are ample to justify the incremental cost.

## Important Notes:

- Annual Energy Reduction:
  - Slab-on-grade house: 1,896 kilowatt-hours
  - Elevated house: 2645 kilowatt-hours
  - Reconstruction and growth total: 935,811,578 kilowatt-hours
- Annual Energy Cost Savings:
  - Slab-on-grade house: $167
  - Elevated house: $233
  - Reconstruction and growth total: $82,445,000
- Annual Emissions Savings
  - Slab-on-grade house: 2277 pounds $CO_2$, 5 pounds $SO_2$, 3.2 pounds $NO_X$
  - Elevated house: 3177 pounds $CO_2$, 7 pounds $SO_2$, 4.4 pounds $NO_X$
  - Reconstruction and growth total: 562,051 tons $CO_2$, 1238 tons $SO_2$, 779 tons $NO_X$
- Cost Recovery period (GAO assumed energy price $0.0881/kWh) for:
  - Slab-on-grade house: 3.7 years
  - Elevated house: 2.7 years
- Cost Recovery period (Current energy price $0.0972/kWh) for:
  - Slab-on-grade house: 3.4 years
  - Elevated house: 2.4 years
- 10 years Savings (Total annual savings – cost increase):
  - Slab-on-grade house: ($167 X 10) - $618 = $1052
  - Elevated house: ($233 X 10) - $618 = $1712
- Status of Energy Codes: (Energy Policy and Conservation Act requires IECC 1998 or better)
  - States meeting 2006 IECC or equivalent: 18 (including Louisiana)
  - States meeting 2003 IECC or equivalent: 10
  - States meeting 1998 – 2001 IECC or equivalent: 7
  - States preceding 1998 IECC or equivalent: 6
- States without statewide energy code: 10

## Sources:


[1] Mark E. Gaffigan, “Energy Efficiency: Important Challenges Must Be Overcome to Realize Significant Opportunities for Energy Efficiency Improvements in Gulf Coast Reconstruction,” United States Government Accountability Office, Washington, D.C., June 2007, pp. 30-31.

[2] “Emissions & Generation Resource Integrated Database,” April 30, 2007, <http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2006_Version2-1.zip>, accessed on April 22, 2008.

[3] “2006 Initial Quarterly Report,” Louisiana Recovery Authority, Baton Rouge, LA, February 2006, p. 1.

[4] “Table 4: Annual Estimates of Housing Units for Counties in Louisiana: April 1, 2000 to July 1, 2006 (HU-EST2006-04-22),” <http://www.census.gov/popest/housing/tables/HU-EST2006-04-22.xls>, accessed on May 22. 2008.