U.S. DEPARTMENT OF ENERGY

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Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

Energy Use Savings for a Typical New Residential Dwelling Unit Based on the 2009 and 2012 IECC as Compared to the 2006 IECC

Letter Report

RG Lucas
VV Mendon
S Goel

April 2013

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NATIONAL LABORATORY

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1.0 Introduction

The 2009 and 2012 International Energy Conservation Codes (IECC) require a substantial improvement in energy efficiency compared to the 2006 IECC. This report averages the energy use savings for a typical new residential dwelling unit based on the 2009 and 2012 IECC compared to the 2006 IECC. Results are reported by the eight climate zones in the IECC and for the national average.

2.0 Overview of Energy Simulation Analysis Methodology[1]

Energy use is calculated using EnergyPlus™ software, Version 5.0. Two buildings are simulated: a 2,400 ft^2 single-family home and an apartment building (a three-story multifamily prototype having six dwelling units per floor) with 1,200 ft^2 dwelling units. These results are combined into a composite average dwelling unit based on 2010 Census building permit data. Single-family home construction is more common than low-rise multifamily construction; the results are weighted accordingly to reflect this. Census data also is used to determine climate zone and national averages weighting for construction activity.

Four heating systems are considered: natural gas furnaces, oil furnaces, electric heat pumps, and electric resistance furnaces. The shares of heating system types were obtained from the U.S. Department of Energy Residential Energy Consumption Survey (2009). Domestic water heating systems are assumed to use the same fuel as the space heating system.

All energy use shown here is in source, or primary energy. Electricity is assumed to have a 3.16 site-to-source conversion factor.[2] Natural gas is assumed to have a 1.10 site-to-source conversion factor.[2] These are both used as simple multipliers to scale site energy usage, in British thermal units (Btu), to source energy.

2.1 Energy Savings for an Average Dwelling Unit

Tables 1 through 5 present the annual energy use in million Btu per dwelling unit. Figures 1 through 5 present the same information graphically. Total energy use is shown in Table 1 and Figure 1. Energy end-uses included here are those regulated by the IECC: space heating, space cooling (air conditioning), domestic water heating, and lighting.

Table 1. Annual Energy Use (Source Energy, Million Btu) for a Dwelling Unit for all IECC Regulated End-Uses (Heating, Cooling, Water Heating, and Lighting)

	2006 IECC	2009 IECC	2012 IECC
Zone 1	122	110	91
Zone 2	141	122	104
Zone 3	134	118	88
Zone 4	154	139	103
Zone 5	171	154	114
Zone 6	199	179	126
Zone 7	244	220	151
Zone 8	399	358	244
National Average	153	137	104

[1] For more information on how these estimates were developed, visit the DOE Building Energy Codes website: www.energycodes.gov/development/residential.
[2] These factors are from Section R405 of the 2012 IECC.

Table 2. Annual Energy Use (Source Energy, Million Btu) for a Dwelling Unit for Heating

	2006 IECC	2009 IECC	2012 IECC
Zone 1	2	2	1
Zone 2	27	24	16
Zone 3	47	41	21
Zone 4	75	64	37
Zone 5	101	89	54
Zone 6	133	117	69
Zone 7	180	159	96
Zone 8	328	291	183
National Average	68	59	34

Table 3. Annual Energy Use (Source Energy, Million Btu) for a Dwelling Unit for Cooling

	2006 IECC	2009 IECC	2012 IECC
Zone 1	83	74	60
Zone 2	71	58	51
Zone 3	41	34	29
Zone 4	29	28	25
Zone 5	23	22	21
Zone 6	18	17	16
Zone 7	11	11	11
Zone 8	7	7	7
National Average	39	34	30

Table 4. Annual Energy Use (Source Energy, Million Btu) for a Dwelling Unit for Domestic Water Heating

	2006 IECC	2009 IECC	2012 IECC
Zone 1	20	20	18
Zone 2	23	23	21
Zone 3	27	27	24
Zone 4	30	30	27
Zone 5	28	28	25
Zone 6	30	30	27
Zone 7	34	34	31
Zone 8	42	42	38
National Average	27	27	25

Table 5. Annual Energy Use (Source Energy, Million Btu) for a Dwelling Unit for Lighting

	2006 IECC	2009 IECC	2012 IECC
Zone 1	17	14	12
Zone 2	20	16	14
Zone 3	19	16	14
Zone 4	19	16	14
Zone 5	19	16	14
Zone 6	19	16	14
Zone 7	19	16	14
Zone 8	22	18	16
National Average	19	16	14

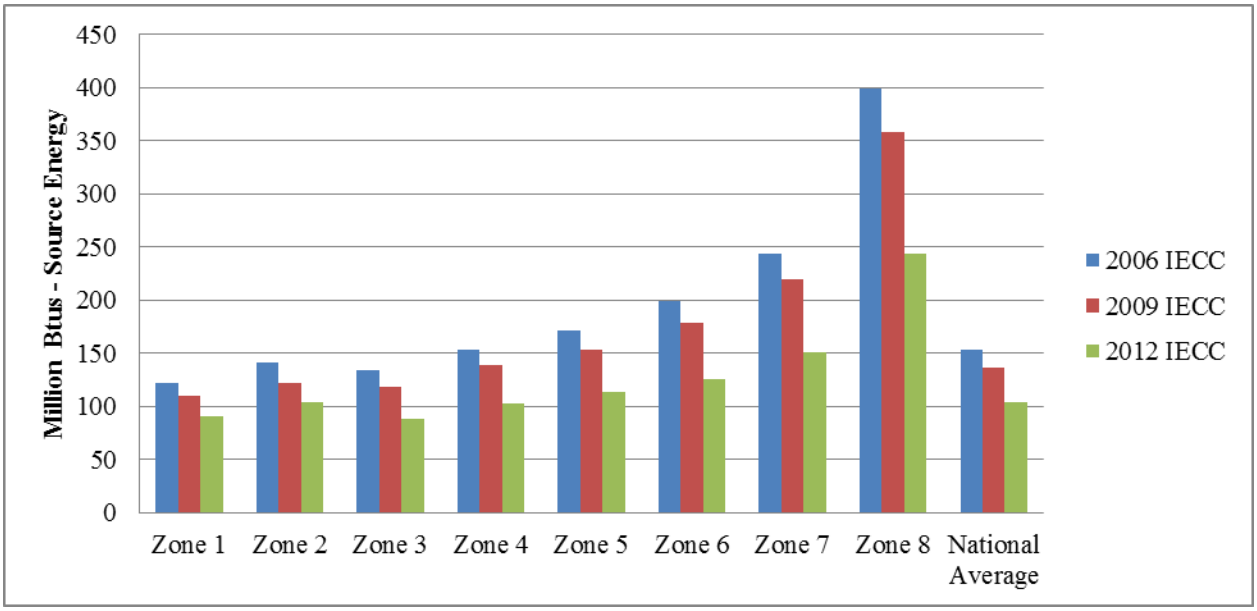

Figure 1. Annual Energy Use for a Dwelling Unit for all IECC Regulated End-Uses (Heating, Cooling, Water Heating, and Lighting)

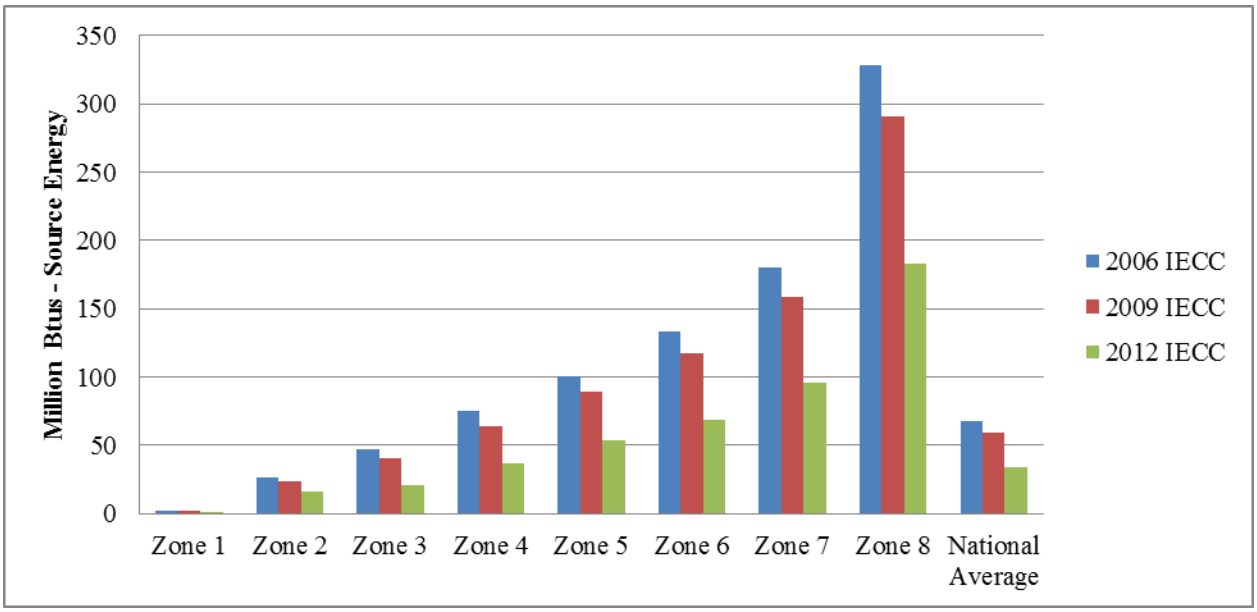

Figure 2. Annual Energy Use for a Dwelling Unit for Heating

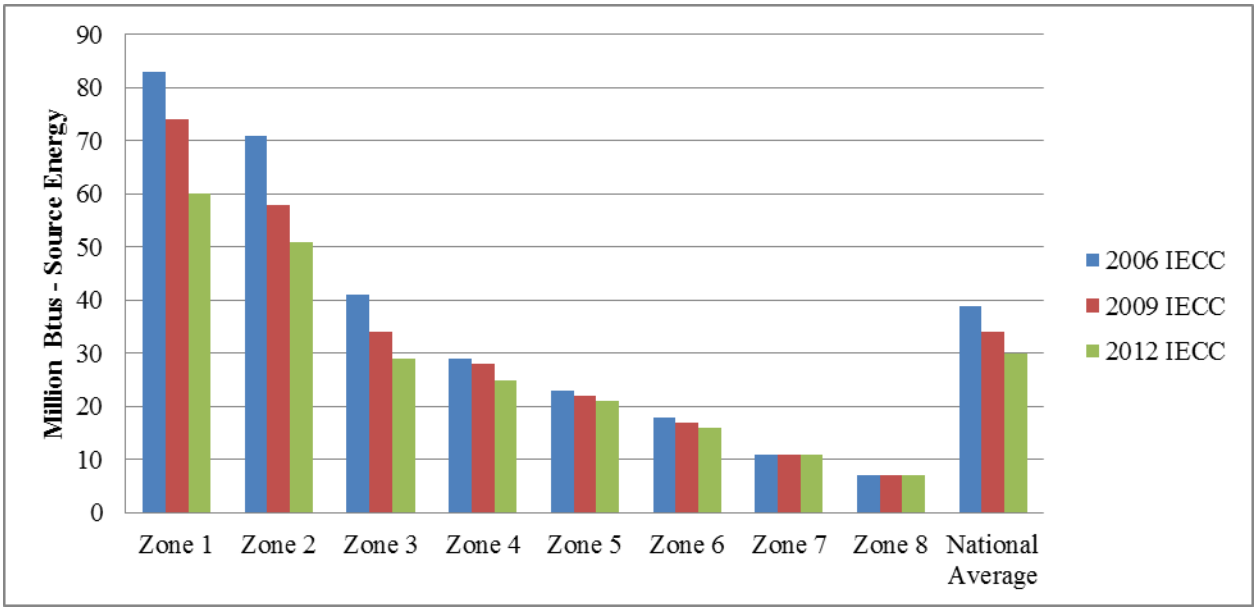

Figure 3. Annual Energy Use for a Dwelling Unit for Cooling

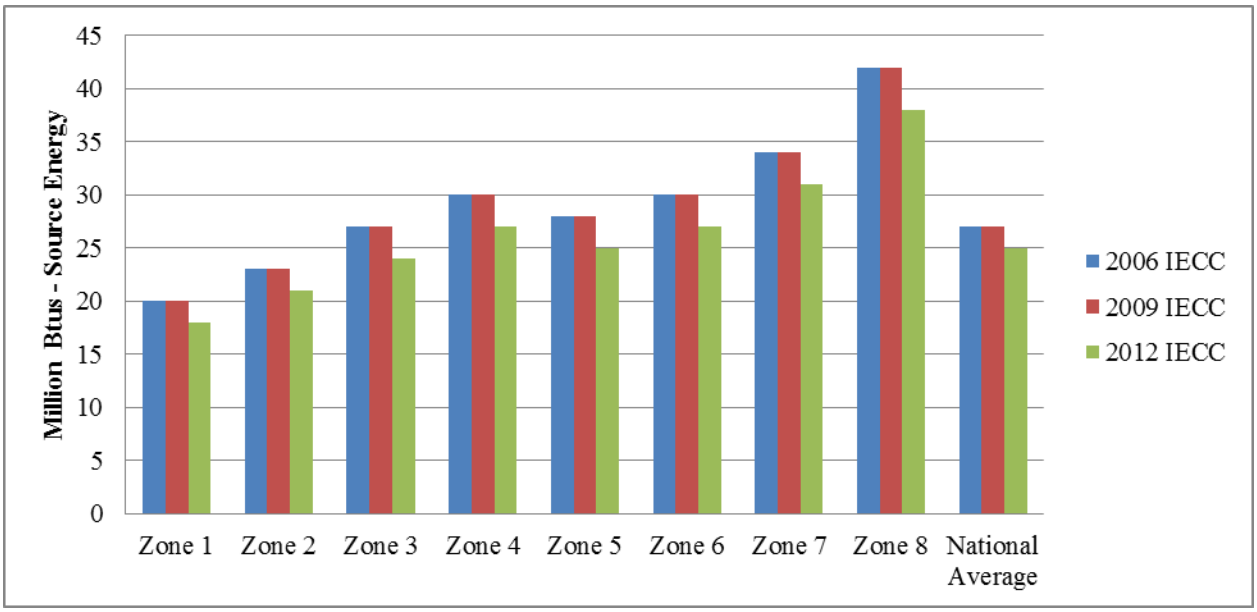

Figure 4. Annual Energy Use for a Dwelling Unit for Domestic Water Heating

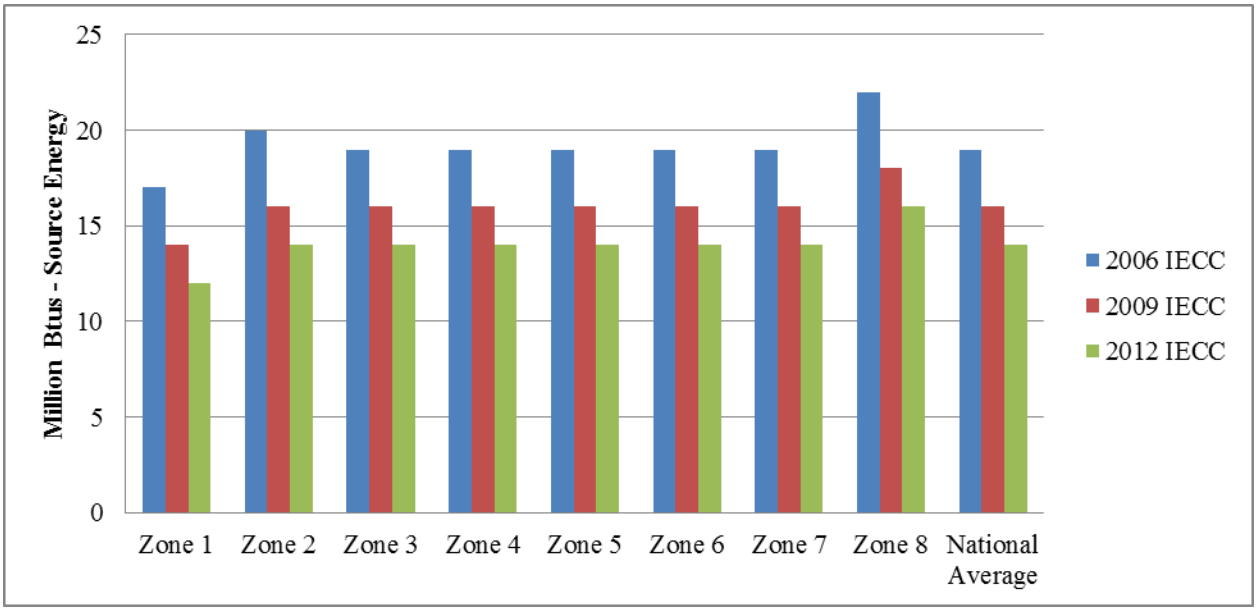

Figure 5. Annual Energy Use for a Dwelling Unit for Lighting

2.2 Total Annual Energy Savings for all Residential Construction

According to 2010 Census data, 537,157 building permits were issued nationwide for housing starts of low-rise residential dwelling units (single-family and multifamily less than three stories) in 2010. If all these were built to the 2009 IECC, a total of 8.59 trillion Btu would be saved annually as compared to the 2006 IECC. In comparison, for the same number of housing starts, the 2012 IECC would save 26.32 trillion Btu over the 2006 IECC.

3.0 References

U.S. Department of Energy. *Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes* . PNNL-21294. Washington D.C.

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