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Cost-Effectiveness Analysis of the Residential Provisions of the 2015 IECC for the State of New York

December 2014

VV Mendon
A Selvacanabady

U.S. DEPARTMENT OF
ENERGY

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

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Pacific Northwest National Laboratory
Richland, Washington 99352

Executive Summary

This analysis was conducted by Pacific Northwest National Laboratory (PNNL) in support of the U.S. Department of Energy's (DOE) Building Energy Codes Program[1] (BECP). DOE supports the development and adoption of energy efficient and cost-effective residential and commercial building energy codes. These codes set the minimum requirements for energy-efficient building design and construction and ensure energy savings on a national level. The basis of the residential building energy codes is the International Energy Conservation Code (IECC) published by the International Code Council (ICC). The IECC is developed and published on a three-year cycle, with a new edition published at the end of each cycle.

This analysis compares the prescriptive and mandatory provisions of the latest published IECC, the 2015 edition published in June this year (ICC 2014), over the 2009 IECC currently adopted by the state of New York. This analysis evaluates the cost-effectiveness of the 2015 IECC over the 2009 IECC for the state of New York for one and two family dwellings, town-homes, and low-rise multifamily residential buildings. The new Energy Rating Index (ERI) path approved for inclusion in the 2015 IECC is not in the scope of this analysis.

DOE has established a methodology for determining energy savings and cost-effectiveness of various residential building energy codes (Taylor et al. 2012). The DOE methodology forms the basis of the present analysis and this report provides additional information used in calculating the cost-effectiveness of the 2015 edition of the IECC over the 2009 edition for the state of New York. PNNL's analysis for New York State compares the 2009 IECC with the 2015 IECC.

PNNL conducted the energy simulation using DOE's *EnergyPlus version 8.0* software (DOE 2013). The two PNNL residential prototype building models representing a single-family and a multifamily building were expanded to 32 models to represent the combinations of commonly used heating systems and foundation types. These 32 models were simulated across the three climate-zones occurring in the state of New York resulting in a complete set of 96 building energy models. The annual energy consumption for space heating, cooling, domestic hot water heating, and lighting was extracted for each case and converted to energy cost using latest fuel prices for the state of New York. Corresponding incremental construction costs associated with the residential provisions of the 2015 IECC were calculated and adjusted using the construction cost multiplier for the state of New York to reflect local construction costs. Finally, a Life cycle cost (LCC) analysis was conducted for each case for evaluating cost-effectiveness of the 2015 IECC over the 2009 IECC.

The 2015 International Energy Conservation Code (IECC) yields positive benefits for New York homeowners. Moving to the 2015 IECC from the 2009 IECC is cost-effective over a 30-year life cycle. On average, New York homeowners will save $12,309 with the 2015 IECC. Each year, the reduction to energy bills will significantly exceed increased mortgage costs. After accounting for up-front costs and additional costs financed in the mortgage, homeowners should see net positive cash flow (i.e., cumulative savings exceeding cumulative cash outlays) in 1 year for the 2015 IECC. Average annual energy savings are $732 for the 2015 IECC.

[1] http://www.energycodes.gov

Table ES.1. Total Energy Cost Savings for the 2015 IECC Compared to the 2009 IECC

Climate Zone	Savings ($/year)	Percent Savings
4	$493	25.6
5	$828	28.3
6	$915	31.1
State Average	$732	28.3

Table ES.2. Life-Cycle Cost Savings for the 2015 IECC Compared to the 2009 IECC

Climate Zone	Savings ($/year)
4	$7,928
5	$14,141
6	$14,747
State Average	$12,309

Table ES.3. Consumers' Cash Flow from Compliance with the 2015 IECC Compared to the 2009 IECC

	Cost/Benefit	Zone 4	Zone 5	Zone 6	State Average
A	Down payment and other up-front costs	$191	$227	$363	$241
B	Annual energy savings (year one)	$493	$828	$915	$732
C	Annual mortgage increase	$103	$123	$197	$131
D	Net annual cost of mortgage interest deductions, mortgage insurance, and property taxes (year one)	-$1	-$1	-$1	$0
E = [B-(C+D)]	Net annual cash flow savings (year one)	$391	$706	$719	$601
F = [A/E]	Years to positive savings, including up-front cost impacts	1	1	1	1

Note: Item D includes mortgage interest deductions, mortgage insurance, and property taxes for the first year. Deductions can partially or completely offset insurance and tax costs. As such, the "net" result appears relatively small or is sometimes even negative.

Table ES.4. Simple Payback Period for the 2015 IECC Compared to the 2009 IECC (Years)

Code	Zone 4	Zone 5	Zone 6	State Average
2015 IECC	3.6	2.6	3.7	3.1

Acronyms and Abbreviations

ACH50	Air-changes at 50-Pascal pressure differential
BC3	Building Component Cost Community
BECP	Building Energy Codes Program
CFL	compact fluorescent lamp
CFM	cubic feet per minute
DOE	U.S. Department of Energy
ECPA	Energy Conservation and Production Act
ERI	Energy Rating Index
ICC	International Code Council
IECC	International Energy Conservation Code
LCC	life cycle cost
PNNL	Pacific Northwest National Laboratory
SHGC	solar heat gain coefficient

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1.0 Introduction

The U.S. Department of Energy (DOE) supports the development and implementation of building energy codes that promote energy efficiency. Title III of the Energy Conservation and Production Act (ECPA), as amended, mandates that DOE participate in the development of model building energy codes and assist states in adopting and implementing these codes. The designated residential model energy code is the International Energy Conservation Code (IECC) published by the International Code Council (ICC).

This report documents the cost-effectiveness analysis of the prescriptive and mandatory provisions of the latest 2015 edition of the IECC compared with the 2009 IECC for residential buildings in the state of New York. The new Energy Rating Index (ERI) path approved for inclusion in the 2015 IECC is not in the scope of this analysis. Pacific Northwest National Laboratory (PNNL) prepared this analysis to support DOE's Building Energy Codes Program. The analysis was conducted using DOE's established cost-effectiveness methodology (Taylor et al. 2012) and code requirements specific to the 2015 and 2009 IECC provisions applicable to single- and low-rise multifamily homes for the state of New York. Commercial and high-rise residential buildings (four or more stories) are not in the scope of the analysis. The methodology assumes that all new buildings implement both the 2009 and 2015 IECC code provisions fully and correctly.

The report contains three main parts:

- Energy Analysis – Section 2 in the report identifies the code changes between 2009 IECC and 2015 IECC applicable to residential single-family and low-rise multifamily buildings. The PNNL residential prototype building models are customized to reflect the requirements of the 2009 and 2015 editions of the IECC applicable to the state of New York. Representative locations for each IECC climate-zone occurring in the state of New York are identified to represent the variability in construction and energy code requirements throughout the state. Energy savings of the energy efficient 2015 IECC over the baseline 2009 IECC are calculated and converted to energy costs using latest fuel prices specific to the state of New York.
- Economic Analysis– Section 3 documents the estimated incremental costs associated with the code changes identified in Section 2 Energy Analysis of the report. It then calculates the Life Cycle Cost (LCC), simple payback period, and annual consumer cash flow for the requirements set by the 2015 IECC over the 2009 edition. The economic parameters used in determining the three cost-effectiveness metric are summarized in this section.
- Results – Section 4 summarizes the energy and consumer benefits of the 2015 IECC compared to the 2009 IECC for each climate-zone within the state of New York as well as the average results for the whole state of New York.

2.0 Energy Analysis

The present analysis focuses only on the prescriptive and mandatory provisions of the 2009 and 2015 editions of the IECC as the compliance path. The first step in evaluating the cost-effectiveness of energy code changes is the estimation of energy use for each case. This section describes the prescriptive provisions of the 2015 IECC which result in a quantifiable impact on energy, the residential prototype building models used to quantify the energy impact of these changes, the conversion of energy savings into energy cost savings and the methodology used to aggregate the results to the climate-zone and state level.

2.1 2015 IECC Provisions with a Quantifiable Energy Impact Applicable to the State of New York

The 2015 edition of the IECC was published by the ICC in June 2014 (ICC 2014). Following its publication, DOE conducted a preliminary qualitative and quantitative assessment of the code changes in the 2015 IECC compared to its predecessor, the 2012 IECC (DOE 2014). Out of the 76 code change proposals approved for inclusion in the 2015 IECC compared to the preceding 2012 edition of the IECC, 6 were considered beneficial and out of these only five apply for the climate-zone occurring in the state of New York. A detailed discussion and analysis of all code change proposals identified for 2015 IECC is documented by Mendon et al (2014).

Previously PNNL had conducted a cost-effectiveness analysis of the 2012 edition of the IECC compared with the 2009 edition for the state of New York in 2012 (Lucas et al., 2012). This earlier study identified the changes between the 2012 IECC and the 2009 IECC applicable to the state of New York. The present analysis builds on the data presented in the previous report and adds information about code changes introduced by the 2015 edition of the IECC when compared to the 2012 edition of the IECC. The additional code changes introduced by the 2015 IECC that specifically apply to the state of New York are summarized below:

2.1.1 Insulation Requirements for Return Ducts in Attics

RE107-13 increases the required insulation on return ducts in attics to a minimum of R-8 (8 ft^2-hr-°F/Btu) where ducts are three inches or greater in diameter and to R-6 (6 ft^2-hr-°F/Btu) where they are less than 3 inches in diameter. This code change impacts all the single-family prototype building models with slab-on-grade foundation because these prototype buildings are assumed to have ducted air-distribution systems with return ducts located in the unconditioned attic as a common practice.

2.1.2 DHW Pipe Insulation Requirements

The 2009 IECC did not require any domestic hot water piping insulation. However, the 2012 IECC contains detailed requirements for insulating domestic hot water pipes. RE132-13 deletes a requirement for insulation on hot water pipes to kitchen spaces and deletes a generic requirement for insulation on long and large-diameter pipes. These changes lower overall efficiency compared to the requirements of hot water piping in the 2015 IECC compared to the 2012 IECC. However, the code change adds a requirement for pipe insulation on 3/4-inch pipes that previously applied only to pipes with diameter greater than 3/4-inch. Because 3/4-inch is the most common size for the long trunk lines in typical residences, this improvement is likely to more than compensate for the efficiency losses from the deletion of insulation requirements for kitchen and long and large-diameter pipes.

2.1.3 Demand-Activated Control for Recirculating Systems

RE125-13 Part I and RE136-13 Part I are discussed together because they both impact domestic hot water recirculating systems. RE125-13 adds new requirements for heated water circulation systems and heat trace systems to be controlled by demand-activated circulation systems, making the IECC consistent with the IRC and the IPC. RE136-13 adds demand control requirements for recirculating systems that use a cold water supply pipe to return water to the tank. These code changes do not require the addition of circulation systems to homes; the added requirements are applicable only when these systems are present in the home. This change affects only homes that have a hot water recirculation system. The 2009 IECC does not include requirements for demand-activated control of hot water recirculation systems.

2.1.4 Outdoor Air Temperature Setback Control for Hot Water Boilers

Part II of CE362-13 adds a requirement that hot water boilers supplying heat to the building through one- or two-pipe heating systems be equipped with an outdoor setback control that lowers the temperature of the hot water based on outdoor air temperature. This code change applies to hot water boilers used for space heating. The code only requires an outdoor setback control to be added to the hot water boiler; it does not specify the control strategy or temperatures for the setback control. This analysis employs the same conservative control strategy used in PNNL’s preliminary determination analysis for evaluating the impact of this proposal (Mendon et al 2014). The 2009 IECC does not include requirements for outdoor air temperature setback control for hot water boilers.

2.2 Summary of Changes between the 2009 and the 2015 IECC

The present analysis builds on the previous analysis conducted by PNNL to evaluate the cost-effectiveness of the 2012 IECC over the 2009 IECC (Lucas et al. 2012). The detailed discussion of the codes changes between the 2012 and the 2009 editions of the IECC is included in the earlier report and not repeated here for brevity. Table 2.1 and Table 2.2 summarize the key code changes between the 2015 and the 2009 editions of the IECC by drawing from the earlier work and adding new information as applicable.

Table 2.1. Comparison of Insulation Requirements Analyzed for the 2009 and the 2015 IECC

Climate Zone	IECC	Ceiling (R-value)	Skylight (U-factor)	Fenestration (Windows and Doors)		Wood Frame Wall (R-value)	Floor (R-value)	Basement Wall (R-value)	Slab* (R-value and depth)
				U-factor	SHGC				
4	2009	38	0.6	0.35	NR	13	19	10/13	10, 2 ft
	2015	49	0.55	0.35	0.40	20	19	10/13	10, 2 ft
5	2009	38	0.6	0.35	NR	20	30	10/13	10, 2 ft
	2015	49	0.55	0.32	NR	20	30	15/19	10, 2 ft
6	2009	49	0.6	0.35	NR	20	30	15/19	10, 4 ft
	2015	49	0.55	0.32	NR	20+5	30	15/19	10, 4 ft

*The first number is R-value. The second value refers to the vertical depth of the insulation around the perimeter.
NR = not required
SHGC = solar heat gain coefficient

Table 2.2. Comparison of Additional Code Requirements Analyzed for the 2009 and the 2015 IECC

Measure Description	2009 IECC	2015 IECC
Insulation Requirements for Return Ducts in Attics	R6	R8
Supply ducts in attics	R-8	R-8
Building envelope sealing	Caulked and sealed, verified by visual inspection against a more detailed checklist	Caulked and sealed, verified by visual inspection and a pressure test against a leakage requirement
Ducts and air handlers	Sealed, verified by visual inspection, and pressure tested, or all ducts must be inside building envelope	Sealed, verified by visual inspection, and pressure tested against a leakage requirement, or all ducts must be inside building envelope
DHW Pipe Insulation Requirements	No pipe insulation	R-3 except where pipe run length is below a diameter-dependent threshold Insulated 3/4" pipes Uninsulated 1/2" and kitchen pipes
Demand-Activated Control for Recirculating Systems	No DHW recirculation system	DHW recirculation system included
Outdoor Air Temperature Setback Control for Hot Water Boilers	No setback	Temperature setback based on Outdoor Air Temperature
Certificate of insulation levels and other energy efficiency measures	Yes	Yes
Tested Max Air Leakage Rate (ACH50)	NR	3

2.3 Estimation of Energy Usage and Savings

In order to estimate the energy impact of residential code changes, PNNL has developed a single-family prototype building and a low-rise multifamily prototype building to represent typical new residential building construction (BECP 2012, Mendon et al. 2013 and Mendon et al. 2014). The characteristics of the single-family prototype and the low-rise multifamily building are described below:

- Single-Family Prototype: A two-story home with a 30-ft by 40-ft rectangular shape, 2,400 ft^2 of conditioned floor area excluding the basement, and windows that are approximately 15% of the conditioned floor area with window areas equally distributed along the four cardinal directions.
- Multifamily Prototype: A three-story building with 18 units (6 units per floor), each unit having conditioned floor area of 1,200 ft^2 and window area equal to approximately 10% of the conditioned floor area, equally distributed along the four cardinal directions.

These two building types are further expanded to cover four common heating systems (natural gas, heat pump, electric resistance and oil), and four common foundation types (slab-on-grade, heated basement, unheated basement, crawlspace), leading to an expanded set of 32 residential prototype building models. Furthermore, the state of New York has three climate-zones leading to a complete set of 96 prototype building models for this analysis. This set of 96 prototype building models was used to simulate the energy usage for typical homes built to comply with the requirements of the 2015 IECC and those built to comply with the requirements of the 2009 IECC using DOE’s EnergyPlus™ software, version 8.0 (DOE 2013). Energy savings associated with space heating, space cooling, water heating and lighting are extracted from the two sets of energy models and converted into cost using the latest fuel prices for the state of New York.

2.4 Fuel Prices

The energy savings from the simulation exercise are converted to energy cost savings using the most recently available state-specific residential fuel prices from DOE’s Energy Information Administration (EIA 2014a, EIA 2014b, EIA 2014c). Because electricity prices vary by the heating or cooling season, summer electricity prices are used for calculating space air-conditioning costs, and winter electricity prices are used for calculating heating energy costs. The fuel prices used in the analysis for the state of New York are shown in Table 2.3.

Table 2.3. Fuel Prices for the State of New York

Electricity Heating ($/kWh)	Electricity Cooling ($/kWh)	Gas ($/Therm)	Oil ($/MBtu)
0.189	0.203	1.853	27.065

2.5 Aggregation Scheme

Cost-effectiveness results are averaged to the climate-zone and overall state level. To determine these averages, the results are first combined across foundation types and heating system types for single-family and multifamily buildings using weighting factors. The distribution of different heating systems for the state of New York is derived from data collected by the National Association of Home Builders data (NAHB 2009) and is summarized in

Table 2.4.

The distribution of different foundation types for the state of New York is derived from the Residential Energy Consumption Survey data (EIA 2009) and is summarized in Table 2.5. The single-family and multifamily results are combined for each climate zone in the state and the climate zone results are combined to determine a state average weighted using housing starts from the 2010 U.S. Census data (Census 2010). The distribution of single- and multifamily building starts is summarized in Table 2.6.

Table 2.4. Heating Equipment Shares

Heating System	Percent Share	
	Single-Family	**Multifamily**
Natural Gas	69.2	49.6
Heat Pump	24.5	39.5
Electric Resistance	1.7	4.9
Oil	4.6	6.1

Table 2.5. Foundation Type Shares

Foundation Type	Slab-on-grade	Heated Basement	Unheated Basement	Crawlspace
Percent Share	20.4	25.9	41.7	12.0

Table 2.6. Construction by Building Type and Climate Zone

Climate Zone	Housing Starts	
	Single-Family	**Multifamily**
4	1,810	2,964
5	5,702	987
6	2,447	257

3.0 Economic Analysis

This section summarizes the cost-effectiveness calculations conducted by PNNL for evaluating the prescriptive and mandatory provisions of the 2015 IECC compared to the 2009 IECC for the state of New York. PNNL calculated three primary economic metrics to evaluate cost-effectiveness:

- Life-Cycle Cost (LCC): Full accounting over a 30-year period of the cost savings, considering energy savings, the initial investment financed through increased mortgage costs, tax impacts, and residual values of energy efficiency measures
- Cash Flow: Net annual cost outlay (i.e., difference between annual energy cost savings and increased annual costs for mortgage payments, etc.)
- Simple Payback: Number of years required for energy cost savings to exceed the incremental first costs of a new code

3.1 Incremental Costs

In order to evaluate the cost-effectiveness of the changes introduced by the 2015 IECC over the 2009 edition, PNNL estimated the incremental construction costs associated with these changes. For this analysis, cost data sources consulted by PNNL include but are not limited to:

- Building Component Cost Community (BC3) data repository (DOE 2012)
- Construction cost data collected by Faithful+Gould under contract with PNNL (Faithful + Gould 2012)
- RS Means Residential Cost Data (RSMeans 2012)
- National Residential Efficiency Measures Database (NREL 2014)
- Cost data from home supply stores

The estimated costs of implementing the prescriptive provisions of the 2012 IECC over the 2009 IECC are taken from the earlier PNNL study (Lucas et al. 2012) and adjusted to present dollars using the general rate of inflation. The additional costs of implementing the prescriptive provisions of the 2015 IECC over the 2012 IECC are added to the adjusted costs to derive the total costs of implementing the prescriptive provisions of the 2015 IECC over the 2012 IECC. These estimated incremental costs are summarized in Table 3.1 and are adjusted upwards by 9.3% (multiplied by 1.093) to reflect local construction costs in the state of New York based on location factors provided by Faithful + Gould (2011).

Table 3.1. Total Construction Cost Increase for the 2015 IECC Compared to the 2009 IECC

	2,400 ft^2 House		1,200 ft^2 Apartment/Condo	
Climate Zone	**Slab, Unheated Basement, or Crawlspace**	**Heated Basement**	**Slab, Unheated Basement, or Crawlspace**	**Heated Basement**
4	$2,756	$2,756	$1,190	$1,190
5	$2,241	$2,521	$1,004	$1,044
6	$3,592	$3,592	$1,497	$1,498

3.2 Economic Parameters Used in Evaluating Cost-Effectiveness

The financial and economic parameters used in calculating the LCC and annual consumer cash flow are based on the DOE cost-effectiveness methodology (Taylor et al. 2012) and summarized below for reference:

- New home mortgage interest rate (fixed rate)
  - 5.0% mortgage interest rate (fixed rate)
  - Loan fees equal to 0.7% of the mortgage amount
  - 30-year loan term
  - 10% down payment
- Other rates and economic parameters:
  - 5% nominal discount rate (equal to mortgage rate)
  - 1.6% inflation rate
  - 25% marginal federal income tax and 6.85% marginal state income tax
  - 0.9% property tax
  - Insulation has 60-year life with linear depreciation resulting in a 50% residual value at the end of the 30-year period
  - Electronic controllers for boilers have a 15-year life resulting in a one-time replacement at the end of the 15th year during the 30-year analysis period
  - Windows, duct sealing, and envelope sealing have a 30-year life and hence no residual value at the end of the analysis period
  - Light bulbs have a 6-year life and are replaced four times during the 30-year analysis period

4.0 Results

This section summarizes the results of the assessment of cost-effectiveness of the 2015 IECC relative to the 2009 IECC. Results for each of three primary cost-effectiveness metrics, LCC, simple payback, and annual cash flow, are presented for each climate-zone within the state of New York as well as the state average.

4.1 Life-Cycle Cost

Table 4.1 shows the LCC savings (discounted present value) over the 30-year analysis period for the 2015 IECC compared to the 2009 IECC. These savings assume that initial costs are mortgaged, that homeowners take advantage of the mortgage interest tax deductions, and that efficiency measures retain a residual value at the end of the 30 years. As shown in Table 4.1, LCC savings are $12,309 for the 2015 IECC.

Table 4.1. Life-Cycle Cost Savings of the 2015 IECC Compared to the 2009 IECC

Code	Zone 4	Zone 5	Zone 6	State Average
2015 IECC	$7,928	$14,141	$14,747	$12,309

4.2 Cash Flow

Most houses are financed and the financial impacts of buying a home that complies with the 2015 IECC requirements compared to the 2009 IECC is important to customers. Mortgages spread the payment for the cost of a house over a long period of time (the simple payback fails to account for the impacts of mortgages). This analysis assumes a 30-year fixed-rate mortgage and that the homebuyers will deduct the interest portion of the payments from their income taxes. Table 4.2 shows the impact of the improvements in the 2015 IECC on the consumers’ cash flow.

As shown in Table 4.2, on average, there is a net positive cash flow to the consumer of $601 per year beginning in year one for the 2015 IECC. Positive cumulative savings, including payment of up-front costs, are achieved in 1 year.

Table 4.2. Impacts to Consumers' Cash Flow from Compliance with the 2015 IECC Compared to the 2009 IECC

	Cost/Benefit	Zone 4	Zone 5	Zone 6	State Average
A	Down payment and other up-front costs	$191	$227	$363	$241
B	Annual energy savings (year one)	$493	$828	$915	$732
C	Annual mortgage increase	$103	$123	$197	$131
D	Net annual cost of mortgage interest deductions, mortgage insurance, and property taxes (year one)	-$1	-$1	-$1	$0
E = [B-(C+D)]	Net annual cash flow savings (year one)	$391	$706	$719	$601
F = [A/E]	Years to positive savings, including up-front cost impacts	1	1	1	1

Note: Item D includes mortgage interest deductions, mortgage insurance, and property taxes for the first year. Deductions can partially or completely offset insurance and tax costs. As such, the "net" result appears relatively small or is sometimes even negative.

4.3 Simple Payback

Table 4.3 shows the simple payback period which is the simple division of the incremental construction cost by the first-year energy cost savings. It yield the number of years required for the energy cost savings to pay back the incremental cost investment without any consideration of financing of the initial costs through a mortgage and the favored tax treatment of mortgages. As Table 4.3 shows, the simple payback period from moving to the 2015 IECC from the 2009 IECC averages 3.2 years.

Table 4.3. Simple Payback Period, Relative to the 2009 IECC (Years)

Code	Zone 4	Zone 5	Zone 6	State Average
2015 IECC	3.6	2.6	3.7	3.1

4.4 Energy and Energy Cost Savings

Table 4.4 shows the estimated annual energy costs, including heating, cooling, water heating, and lighting per home that result from meeting the requirements of the 2009 IECC and 2015 IECC while Table 4.5 shows the respective total annual site and source energy use intensities.

Table 4.4. Annual Energy Costs for 2009 and 2015 IECC

Climate Zone	2009 IECC					2015 IECC				
	Heating	Cooling	Water Heating	Lighting	Total	Heating	Cooling	Water Heating	Lighting	Total
4	$872	$378	$418	$256	$1,924	$492	$351	$363	$225	$1,431
5	$1,782	$328	$479	$334	$2,923	$1,050	$327	$426	$291	$2,095
6	$1,843	$264	$490	$344	$2,941	$1,020	$269	$438	$300	$2,026
Average	**$1,487**	**$333**	**$461**	**$309**	**$2,590**	**$856**	**$324**	**$407**	**$271**	**$1,858**

Table 4.5. Annual Site and Source Energy Use Intensities for 2009 and 2015 IECC for New York

Climate Zone	2009 IECC			2015 IECC		
	Total kWh/ft^2-yr	Total $therm/ft^2$-yr	Total Source $MBtu/ft^2$-yr	Total kWh/ft^2-yr	Total $therm/ft^2$-yr	Total Source $MBtu/ft^2$-yr
4	3.82	0.20	0.061	3.19	0.14	0.048
5	3.68	0.31	0.071	2.93	0.21	0.052
6	3.50	0.32	0.069	2.70	0.20	0.049
Average	3.69	0.27	0.067	2.97	0.18	0.050

Table 4.6 shows the total energy cost savings as both a net dollar savings and as a percentage of the total energy costs. Results are averaged across single- and multifamily housing starts, foundation type, and heating system type. As can be seen from the table, annual energy cost savings per year for the 2015 IECC compared to the 2009 IECC range from $493 in Zone 4 to $915 in Zone 6. On a percentage basis, energy cost savings average 28.3% for the 2015 IECC over the 2009 IECC.

Table 4.6. Total Energy Cost Savings for the 2015 IECC Compared to the 2009 IECC

Climate Zone	Savings ($/year)	Percent Savings
4	$493	25.6
5	$828	28.3
6	$915	31.1
State Average	$732	28.3

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