Potential Job Creation in Rhode Island as a Result of Adopting New Residential Building Energy Codes

Final Report

MJ Scott
JM Niemeyer

September 2013

Pacific Northwest NATIONAL LABORATORY

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1.0 Introduction

Are there advantages to states that adopt the most recent model building energy codes other than saving energy? For example, can the construction activity and energy savings associated with code-compliant housing units become significant sources of job creation for states if new building energy codes are adopted to cover residential construction? [1, 2] The U.S. Department of Energy (DOE) Building Energy Codes Program (BECP) asked Pacific Northwest National Laboratory (PNNL) to research and ascertain whether jobs would be created in individual states based on their adoption of model building energy codes.

Each state in the country is dealing with high levels of unemployment, so job creation has become a top priority. [3] Many programs have been created to combat unemployment with various degrees of failure and success. At the same time, many states still have not yet adopted the most current versions of the International Energy Conservation Code (IECC) model building energy code, when doing so could be a very effective tool in creating jobs to assist states in recovering from this economic downturn.

1.1 Summary of Results

An analysis conducted by PNNL for BECP found that transforming the U.S. housing stock through the adoption of more energy-efficient building energy codes could create hundreds of jobs in each of several states. In comparison to the other states analyzed, the impacts in Rhode Island were smaller. There are two main reasons for this: 1) the state's small housing market size and 2) the fact that Rhode Island had already adopted the 2009 IECC, unlike some of the other states, leaving less scope for upgrading. Between the years 2000 and 2010, Rhode Island built an average of about 2,100 new housing units per year. [4] In the depressed building climate of 2010, the state constructed about 930 new units. At the higher "typical" rate of construction, each year class of code-compliant construction in Rhode Island would support up to an additional 40 short-term jobs and up to an additional $2 million in short-term labor income per year. In the long term, in addition to saving Rhode Island consumers $2 million per year thereafter, each year class would annually provide support for about five jobs and less than $0.5 million in labor income in the state's economy. [5]

The long-term impact is likely to be larger than this, however. A constant rate of residential construction merely maintains the level of short-term impact since it depends on one-time additions to the stock of incrementally more efficient buildings. The segment of housing units affected by the upgraded building energy code continues to generate energy savings over the lifetime of the housing unit, in lieu of the housing unit that would have been built. [6] Therefore, the annual level of energy savings (and resulting employment and income impacts) shifts upward as the housing stock built under the upgraded building energy code expands. For example, at a constant rate of construction for three years, the third year would see 40 short-term jobs supported, but the long-term component of support, which depends on the three years' worth of energy savings from code-compliant housing stock, would have grown to roughly 5 + 5 + 5 = 15 jobs. This long-term impact would continue to accumulate in subsequent years until the entire housing stock eventually is transformed with code-compliant housing units. [7] In the long term, the long-term savings component dominates. Potential job creation for a single year class will fall into three categories:

Direct Job Creation This is job creation in the construction-related industries due to new workers designing, building, and inspecting new structures. In the short term, Rhode Island could see approximately 20 new jobs and $1 million in labor income as a result of direct job creation due to adoption of the 2012 IECC. Energy savings would sustain fewer than five direct jobs and less than $0.5 million in finance, insurance, the retail and services sector, and government in the long term.

Indirect Job Creation Indirect job creation occurs in industries supplying inputs to the directly affected industries. This could affect manufacturers, suppliers, and retail stores. Rhode Island could see about ten indirect new jobs and $0.5 million in labor income in the short term and support for fewer than five jobs and less than $0.5 million in labor income in the long term as a result of indirect economic activity.

Induced Job Creation This is job creation that occurs in the local economy as a result of increased consumer spending based on direct and indirect earnings. Induced employment occurs as workers in direct and indirect supporting industries spend money from their new jobs elsewhere in the local economy. Rhode Island could see up to ten induced jobs and $0.5 million in the short term, and support for less than five jobs and less than $0.5 million per year in the long term as a result of induced economic activity.

2.0 Analysis

To calculate the impact of implementing an upgraded residential building energy code in Rhode Island, PNNL used IMPLAN,® a widely accepted economic input-output model, to estimate employment impacts.[8] IMPLAN, a product of MIG, Inc. (formerly Minnesota IMPLAN Group, Inc.), contains highly disaggregated data on regional economic indicators, and converts user inputs into employment impacts. It is based on social accounting between industries and within the distribution chain, and contains numerous economic multipliers to quantify direct, indirect, and induced employment impacts. Output from IMPLAN is in the form of direct, indirect, and induced economic output (gross state product), jobs, and labor income created or supported, as well as their associated multipliers.

As with most economic impact models, for IMPLAN to be able to estimate the impact of a given economic activity, it is necessary first to obtain estimates of the level of direct new spending that would occur in the economy as a result of that activity. Much of the research effort in an impact study is dedicated to collecting, analyzing, and organizing economic data to properly characterize the economic activity in question. In the current study, it was necessary to obtain or estimate data to characterize the comparative costs to build single-family and multifamily housing units in Rhode Island that are compliant with the current Rhode Island residential energy code and the 2012 IECC Residential Provisions.[9,10] In addition, PNNL estimated the energy savings that result from the new code, the market value of those energy savings, and the likely distribution of the value of costs and savings across the various sectors of the Rhode Island economy. The methodological details are contained in Appendix A and the inputs to the model are shown in Appendix B. PNNL had already characterized most of the incremental investment, incremental savings, and consumer cash flows associated with construction and operation of more energy-efficient residential buildings for national and state cost-effectiveness studies of the 2009 and 2012 IECC residential provisions. The national study was published as DOE (2012a) and the Rhode Island state volume is available online (DOE 2012b). Those data were utilized in this study.

There are some methodological differences between the life-cycle cost and cash flow analyses in the residential building energy code cost-effectiveness studies on the one hand, and economic impact studies on the other. These differences result in slightly different treatment of the same data. Put simply, the cost- effectiveness studies emphasize the present value of discounted positive and negative cost streams from the perspective of a homeowner.[11] Impact studies follow the consequences of changes in (for example) investments on the level of activity throughout the economy, regardless of whether or not the benefits of the investment exceed the costs. Thus, for example, energy savings that cost less than their value to produce are clearly beneficial to the homeowner, but an impact study is only concerned with the effect that both the savings and the costs have on the overall level of production, employment, and income in the economy, regardless of whether or not the investment is cost effective.

Table 1 summarizes the short-term and long-term cash flows in the Rhode Island economy associated with an upgrade of the residential building energy code from the current level to 2012 IECC. This is the impact associated with one year's worth of new construction. It is divided into the short-term impacts associated with the construction period and the long-term annual impacts that occur during the lifetimes of the housing units that are built. The size of the impact depends on the level of future housing starts. Two levels of future housing starts are shown in Table 1—the depressed level that prevailed in 2010 and the more-typical average of the levels that prevailed from 2000 through 2010. These cash flows (positive or negative) are inputs to the IMPLAN model and are converted by the model into corresponding estimates of changes in potential short-term and long-term overall economic activity in the Rhode Island economy, as indicated in Table 2. The impact is shown at two levels of future housing starts—the depressed level in 2010 and the average level of housing starts from 2000 to 2010.[12]

Table 1. Investments and Other Cash Flows in the Rhode Island Economy Associated with Upgrading the Residential Building Energy Code: Inputs to the IMPLAN Model

Item and Direction of Impact on Economy (+ or -)	IECC 2009 to IECC 2012	
	2010 Housing Starts	**2000-2010 Average Housing Starts**
Housing Starts	934	2,070
Short Term (Thousand 2011$):		
Construction (+)	1,564	3,466
Finance Fees (+)	10	23
Annual Long Term (Thousand 2011$):		
Mortgage Repayments (+)	91	201
Insurance (+)	7	17
Property Taxes (+)	14	31
Other Consumption (+)	496	1,099
Electricity Sales (-)	119	263
Natural Gas Sales (-)	240	532
Fuel Oil Sales (-)	228	505

Source: PNNL Cost-Effectiveness Database.

Table 2. Potential Economic Impact in the Rhode Island Economy Associated with Upgrading the Residential Building Energy Code: Jobs and Labor Income

	IECC 2009 to IECC 2012	
Impact	**2010 Housing Starts**	**2000-2010 Average Housing Starts**
Housing Starts	934	2,070
Short-Term Impacts		
Jobs	20	40
Labor Income (Million 2011$)	1	2
Annual Long-Term Impacts		
Jobs	<5	5
Labor Income (Million 2011$)	<0.5	<0.5

3.0 References

DOE – U.S. Department of Energy. 2012a. *National Energy and Cost Savings for New Single– and Multifamily Homes: A Comparison of the 2006, 2009, and 2012 Editions of the IECC*. Building Energy Codes Program, Washington, D.C. Accessed June 9, 2012 at: http://www.energycodes.gov/sites/default/files/documents/NationalResidentialCostEffectiveness.pdf.

DOE – U.S. Department of Energy. 2012b. *Rhode Island Energy and Cost Savings for New Single– and Multifamily Homes: 2009 and 2012 IECC as Compared to the 2006 IECC*. Building Energy Codes Program, Washington, D.C. Accessed June 21, 2012 at: http://www.energycodes.gov/sites/default/files/documents/Rhode IslandResidentialCostEffectiveness.pdf.

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[1] Throughout this document we collectively refer to model building energy codes and building energy codes. The former are promulgated by the International Code Council (ICC) as models for adoption in legislation or regulation. The latter term will be used when referring to their being adopted by reference or by incorporating the text of the model code directly in laws or regulations, with or without amendments.

[2] The analysis in this report assumes that a newly constructed housing unit minimally complies with the building energy code in effect the year it is constructed.

[3] The analysis in this report covers the 50 states and the District of Columbia, but not U.S. territories.

[4] Housing units refers to residential buildings as defined in the IECC model building energy code: one- and two-family buildings, townhouses, and each individual dwelling unit in multifamily buildings not over three stories in height. Housing stock is the existing number of such units at a point in time. Manufactured housing, which is regulated by 24 CFR Part 3280, is not considered in this study.

[5] The analysis in this report assumes that a newly constructed housing unit minimally (just) complies with the building energy code in effect during the year it is constructed and supports construction jobs only during the year of construction (short term). The total number of housing units constructed during a given year comprise a "year class" (e.g., the class of 2012 is all units built during 2012), each unit of which is assumed to minimally comply with the building energy code being analyzed (the 2012 IECC as applicable to residential buildings) during its lifetime (long term). The long-term savings shown in the report are shown only for a single year class and are calculated by subtracting estimated energy use complying with a more energy-efficient building energy code (2012 IECC) from energy use complying with the baseline code (assumed to be the 2009 IECC in Rhode Island). The analysis ignores further potential building energy code changes, any future energy efficiency improvements to a given year class, any efficiency improvements resulting from home energy rating systems (HERS) or other "market-pull" or incentive programs, and any efforts to go "beyond code." These are all considered separate energy efficiency improvement efforts, not impacts from applying the more energy-efficient building energy code. The analysis implicitly assumes that energy savings come only from application of a given upgraded code to all subsequent new construction.

[6] Throughout this report, the term "upgrade" means to adopt some variant of a building energy code more energy efficient than the current one or a new edition of a model energy code that is more energy efficient than the previous edition.

[7] The impact shown is conservative because we have assumed that once the 2012 IECC model building energy code is adopted, that version of the code remains in place forever. However, the ICC regularly upgrades its model code, and jurisdictions regularly upgrade their building energy codes in response, so in reality further impacts can be expected as a result of these upgrades.

[8] IMPLAN. Version 3.0. Hudson, WI: MIG, Inc.

[9] Rhode Island is currently under the provisions of the 2009 edition of the IECC. The IECC criteria vary by climate zone and break the United States into eight zones by county representing their relative climatic conditions. Rhode Island is in Climate Zone 5 (see Figure A.2 in Appendix A for a map). The "current code" for purposes of this analysis is considered to be the 2009 IECC. For purposes of this analysis it is implicitly assumed that all building energy codes are adopted statewide and have 100 percent compliance. Programs to verify compliance such as code enforcement by local jurisdictions and their costs and employment consequences were not included in this analysis.

[10] The definition of residential buildings does not change between the 2009 and 2012 IECC, however the latter edition has totally separate provisions for residential buildings (IECC Residential Provisions), while the former did not totally separate residential and commercial building provisions.

[11] Homeowner as used here includes renters and lessees. Renters and lessees are assumed to indirectly pay the building owner’s mortgage and property taxes through rent or lease payments and directly or indirectly (as part of the rent or other fee) also pay the energy bill.

[12] Housing start data were obtained from the U.S. Department of Housing and Urban Development (HUD) State of the Cities Data Systems (SOCDS), which reports total new single family and multifamily housing units authorized by building permits each year in every state and the District of Columbia. Units authorized include in 1, 2, 3-4, and 5+ unit buildings. Some new 5+ unit buildings likely were over three stories in height and therefore would have been covered by the provisions of the IECC building energy code applicable to commercial buildings rather than the residential provisions. However, in this analysis all units were assumed to be covered by the residential provisions. In Rhode Island in 2010 about 22 percent of all units were in the multifamily category. Separately, the U.S. Census Bureau data shows that the percentage of units in multifamily residential buildings of four or more stories (considered commercial buildings in the IECC) varies considerably from year to year, but that the average from 2000-2010 was about 32 percent. This implies that, at most, about 7 percent of residential units might be covered by the commercial provisions of the IECC rather than residential provisions of the IECC and our estimates may be high by that amount. On the other hand, the building energy codes also apply to a portion of the several thousand residential additions, renovations, and alterations that occur in each year in Rhode Island. Restricting the analysis in this report only to new construction offsets at least some of the overstatement of impact resulting from the inclusion of high-rise multifamily. The SOCDS data are collected by the U.S. Census Bureau. SOCDS documentation notes that authorized units data on the Census website does not include concurrent year revisions to preliminary monthly data, nor does it reflect any of the revisions found in the final monthly data. Census displays only their originally published data while SOCDS data reflects all subsequent Census revisions.

Appendix A

A Method to Estimate Job Creation Potential in States as a Result of Enhanced Building Energy Code Adoption

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A.1 Introduction: How the Economy Works to Create Jobs

The purposes of building energy codes are to save energy, save consumers money, reduce the negative environmental impacts of energy production and consumption, and reduce dependence of the economy on insecure sources of energy. Implementing new cost-effective building energy codes saves more dollars' worth of energy than it costs the economy, increasing national wealth and providing opportunities for economic growth. Additionally, like any other cost-effective investment, building energy codes can help create jobs and reduce unemployment.

Demand for a good or service generates demand for the resources needed to create the good or service and make it available for purchase. The values of the required resources are costs of production. Economists often categorize the required resources as labor, purchased materials and services, and purchased land and equipment costs. Because labor is a cost of production, the number of jobs and size of income growth in the economy is primarily associated with the scale of overall economic activity in the economy. However, because some sectors of the economy require more labor per dollar of output than others, the level of employment and income also depends on the distribution of economic activity among sectors. For example, most consumer spending and construction are "labor intensive" (require more labor per dollar of output) while most industrial production and the utility sectors are more "capital intensive" (require less labor per dollar of output). Thus, purchases from sectors with high labor requirements tend to generate more jobs per dollar of output. Because purchased materials, equipment, and services themselves must be produced, increased demand for final purchases–for example, a single-family house– not only creates demand for labor to build the house[1], but also intermediate or indirect demand for labor and other resources to make the components such as windows, lumber, fiberglass, pipe, and supporting services such as architectural plans, legal documents, etc. Payments flow from the prospective homeowner or developer to the first level of suppliers of goods and services (final demand[2]), on to the indirect and intermediate suppliers, and finally to the economy as a whole. If the economy in question is the economy of, for example, a U.S. state, many of the payments go beyond the borders of the state to other states and ultimately, some to other countries. As payments increase or decrease in various sectors, the demand for labor and the number of jobs increases or decreases. The overall impact on jobs is the net effect of all of the increases and decreases in demand.

A.2 How Building Energy Codes Create Jobs

Pacific Northwest National Laboratory (PNNL) conducted research on the potential employment impacts associated with the adoption of and compliance with more energy-efficient residential building energy codes on a state-by-state basis. PNNL analyzed two sources of potential job creation: short-term impacts of the investment required to implement the codes, and the long-term impacts of the resulting energy savings. Figure A.1 is a simplified picture of payment flows within a state economy associated with a cost-effective upgrade to a residential building energy code.

The figure is divided into the short term (1a), when an incremental investment is made with funds from the homeowner or developer and borrowed funds to comply with a more energy-efficient building energy code, and the longer term (1b), when the homeowner or renter enjoys lower energy bills, but must pay back the mortgage, purchase insurance, and pay increased property taxes.[3]

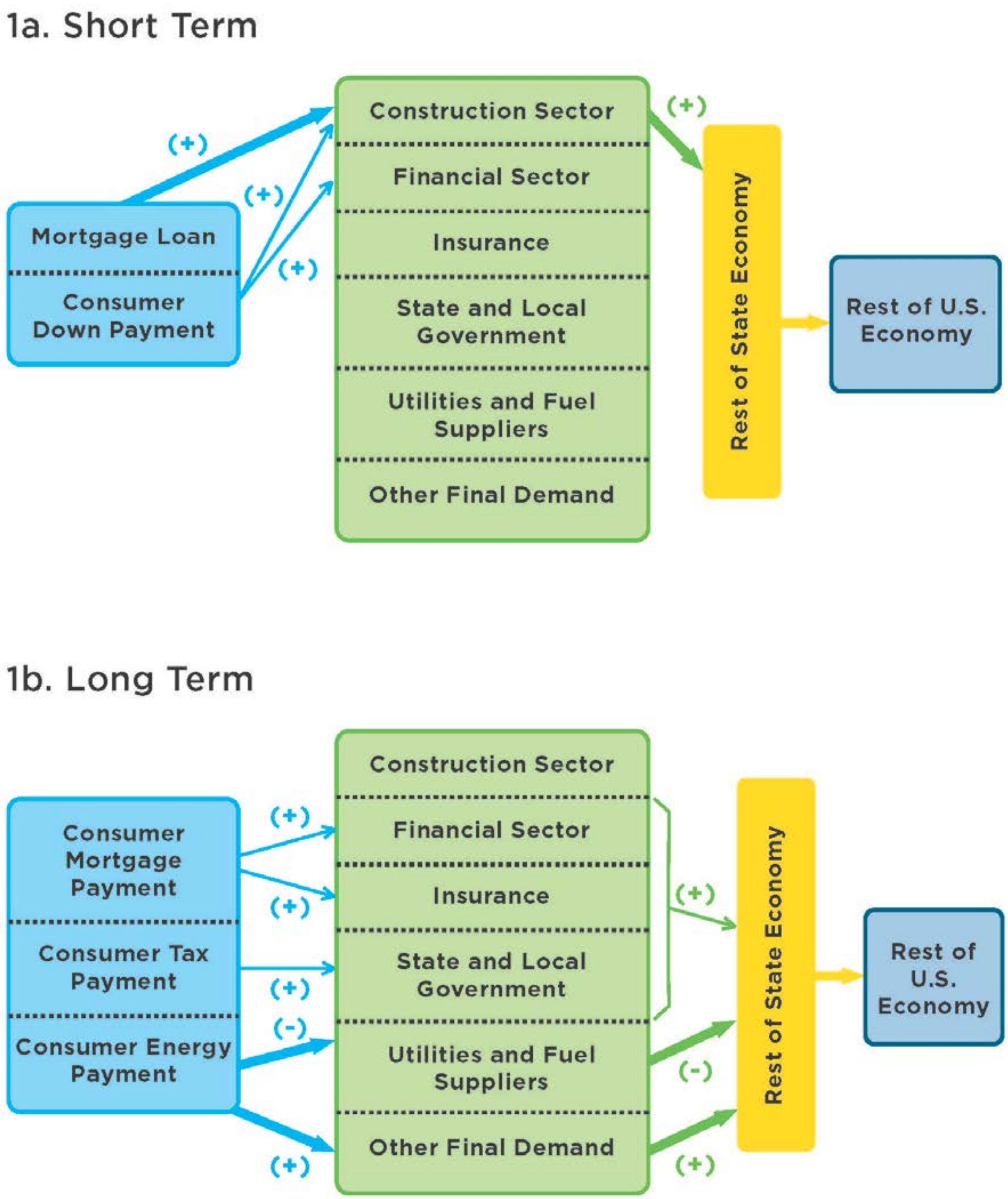

Figure A.1. Changes in Payment Flows Associated with More Energy-Efficient Residential Building Energy Codes

Potential job growth comes from the following sources. In the short term, as shown in Figure A.1, implementing upgraded building energy codes requires an incremental investment in the housing stock, paid for with a direct increase in the size of the mortgage on the building and an increase in the size of the consumer or developer down payment on the loan for the new housing unit. These are shown in 1a as increases in payment flows ("+") primarily into construction, but also include some fees to financial institutions to arrange the mortgage. The investment itself requires short-term increases in economic activity within the construction industry. This economic activity directly generates labor hours and income in construction, and provides markets for goods and services in industries in the rest of the economy that supply windows, insulation, lighting and other items required by the building energy codes. Additional labor hours in manufacturing and distribution channels are required to fill these orders. The prospective homeowner (or developer) is assumed to have saved most or all of the down payment, and will not reduce other purchases as a result of having to make the down payment. The main payment impacts are shown in the heavier arrows.

In the long term (1b), more energy-efficient buildings save energy over several decades. The energy savings that occur due to a more energy-efficient housing stock are real resource cost savings to the economy, not just the homeowner, developer, or renter. Because building energy codes are cost-effective (i.e., they save more over time than they initially cost to satisfy) (DOE 2012), they create a real and permanent increase in wealth. The payment flows associated with long-term consumer savings are shown in Figure A.1 part 1b. As in 1a, the predominant payment flows are shown as heavier arrows. First, the homeowner or developer/renter (directly/indirectly) experiences a reduction in payments to electric and gas utilities and fuel suppliers (shown as "-" payment to utilities and fuel suppliers). Out of those savings, the homeowner or building owner begins to pay back the increment to the mortgage loan and insurance required should the building be more expensive to construct under an upgraded building energy code, and pays the higher property tax bill associated with the more valuable building ("+" flows to state and local government and the financial sector). The rest of the money associated with the energy savings can be spent on other goods and services in the economy just like any other income, in turn creating additional employment opportunities. While the energy generation and distribution sectors would experience a reduction in sales that partially offsets these impacts, the overall impact on job and income opportunities is positive. While the (-) payments to the energy suppliers may exactly match the sum of the (+) payments to financial and insurance firms, state and local government, and the rest of the economy, the labor intensity of the economic activity associated with (+) payments is larger than for the (-) payments.

Following the methodology outline in the next section, the impact analysis found that adoption of more aggressive residential building energy codes could create thousands of new jobs in construction and related industries in the states where they are implemented and save consumers hundreds of millions of dollars each year in utility bills in the long run, creating additional positive net long-term employment opportunities.

A.3 Classifying Economic Impacts

Economic impacts fall into three categories: direct, indirect, and induced. Direct impacts are the changes in the value of economic activity, employment, and employee income in the sectors experiencing changes in sales as an immediate result of investment and savings. Indirect impacts occur in industries that supply the sectors experiencing direct impacts. For example, a construction firm might experience a direct impact from investment, while its wholesale supplier or a fiberglass manufacturer would experience indirect impacts. Direct impacts of consumer spending of energy savings in the "rest of the economy" could occur in a wide variety of sectors, ranging from restaurants to furniture stores to barbershops, and similarly for indirect impacts. Finally, induced impacts occur as employees of directly and indirectly affected firms spend their additional earnings. The following sections summarize how PNNL conducted the analysis.

A.3.1 Direct Impacts

To estimate the direct impact of the required investment, PNNL first analyzed in detail the bill of labor and "materials" (the latter includes both purchased goods and business services) required to build prototype single-family and multifamily housing units in individual states under current and more energy-efficient building energy codes. The required amounts of labor and materials generally increase with the level of energy efficiency desired. Examples of required labor include designers, construction workers, installers, and code enforcement personnel (plan review and inspection). Note that some of these may be provided as business services rather than direct hires by construction firms. Examples of required materials include such items as fenestration (windows, skylights and doors), insulation, ductwork and sealants, lighting fixtures, contracted services, etc. The bills of labor and materials analyzed by PNNL were the same as those used in the U.S. Department of Energy's cost-effectiveness analysis originally conducted in evaluating the 2012 International Energy Conservation Code (IECC) Residential Provisions compared with provisions of the 2009 and 2006 editions of the IECC applicable to residential buildings (DOE 2012).[4] PNNL multiplied the differences in the costs of labor and materials for prototype residential buildings at the various energy code levels in the state by the number of housing starts in the state to obtain overall differences in the value of investment by economic sector that would be experienced from implementing the more recent editions of the IECC in that state. The amount of the difference in value of investment is the impact on investment final demand. In Taylor et al. 2012, PNNL included the mortgage amount, the down payment, and other upfront costs in the investment final demand. The same accounting was followed in this study.

To estimate the direct impact of energy savings associated with varying levels of energy efficiency associated with different editions of the IECC, PNNL first compiled the projected differences in annual consumption of natural gas, electricity, and fuel oil[5] by end use for prototype residential buildings. These differences were determined in the 2012 cost-effectiveness analysis at each level of energy efficiency resultant from meeting the provisions of different editions of the IECC in each state (Taylor et al. 2012). PNNL then aggregated the differences by fuel, and multiplied by housing starts to obtain the statewide impacts. Energy savings were priced at prevailing residential prices in each state for the year 2011. The dollar value of the energy savings was assumed to be spent as follows. Following the PNNL cost-effective analysis (Taylor et al. 2012), the researchers calculated the annual mortgage payment required to pay off the incremental mortgage cost for the more valuable[6] housing unit over a period of 30 years at a mortgage interest rate of 5 percent. This study also adopted the PNNL (Taylor et al. 2012)-assumed increase in the annual property tax bill and the increase in property and mortgage insurance. Because the investment is cost-effective, these items add to less than the energy savings. The homeowner is assumed to spend the remainder of the projected savings in the same proportions as other consumer income earned in the state, yielding an estimate of increased consumer spending in several economic sectors as a result of the savings. The savings-related increased consumer spending within the state is the positive element of the impact on consumer savings-related final demand.[7]

To estimate the negative direct impact of reduced energy sales in a state, PNNL allocated the dollar value of energy savings (with a negative algebraic sign) as reduced sales by the natural gas utilities, electric utilities, and fuel oil suppliers in the state.[8] This is the negative element of the impact on utility final demand. Generally speaking, gas and electric utilities and fuel oil suppliers are very capital intensive, with very few employees per million dollars of sales compared with other industries. Thus, changing the mix of consumer final demand from energy to other sectors generally increases the demand for labor, other things being equal.

A.3.2 Indirect, Induced, and Total Impacts

PNNL estimated the indirect and induced job impacts using the state-level version of IMPLAN,® a widely accepted economic national and regional input-output model.[9] IMPLAN is a product of MIG, Inc. (formerly Minnesota IMPLAN Group, Inc.), and contains detailed data on sales and purchases, employment, and related economic series. It shows quantitatively how a change in direct spending or employment in any of more than 400 sectors of the state economy requires changes in supporting economic output, employment, and earned income in all of the other sectors in the state (indirect impact). In addition, using consumer spending patterns, the IMPLAN model can track the subsequent spending of additional income paid to employees of the directly and indirectly affected sectors and can calculate the additional resulting impacts on economic output, employment, and income of that activity (induced impact). The sum of direct, indirect, and induced impacts on the value of economic output, employment, or income is called the total impact. MIG, Inc. can customize IMPLAN for any state, county, or other subnational region of interest in the United States.[10] The model converts user-supplied estimates of final demand into impacts on indirect, induced, and total economic output, employment, and income. It is based on MIG's "social accounting" for economic relationships between industries and regions, and within the distribution chain for goods and services. Of particular interest in the current study is output from IMPLAN on the impact of investment final demand, consumer final demand, and utility final demand on state-level direct, indirect, induced, and total jobs.

The following sections show how PNNL estimated changes in final demand.

A.4 Determine Values of Direct Investment by Sector

PNNL used residential building investment data from Taylor et al. 2012 as a basis for estimating incremental investment cost. Table A.1 shows the required investment for an average housing unit (covering single-family and multifamily units, with the proportion of each varying by state) by climate zone in the national cost-effectiveness analysis (DOE 2012). State-level analyses have been produced and are available online at www.energycodes.gov/development/residential/iecc_analysis/. Table A.2 shows the incremental costs for each level of residential building energy code adoption determined in PNNL's state-level supporting estimates of cost-effectiveness of the 2009 and 2012 IECC. Details of the cost-effectiveness methodology can be found in Taylor et al. 2012. Figure A.2 is a map of the U.S. climate zones, showing the zones affected in this report.

Table A.1. Incremental Investment from More Efficient Building Energy Codes by U.S. Climate Zone

Climate Zone	Shift from 2006 IECC to 2009 IECC (2011$)	Shift from 2006 IECC to 2012 IECC (2011$)	Shift from 2009 IECC to 2012 IECC (2011$)
1	1,317	2,813	1,496
2	1,223	2,841	1,618
3	1,261	3,377	2,107
4	555	2,314	1,759
5	875	2,399	1,524
6	922	3,405	2,484
7	677	3,236	2,559
8	950	4,704	3,763

Source: Derived from Tables A.9, A.10, and A.11 in DOE 2012.

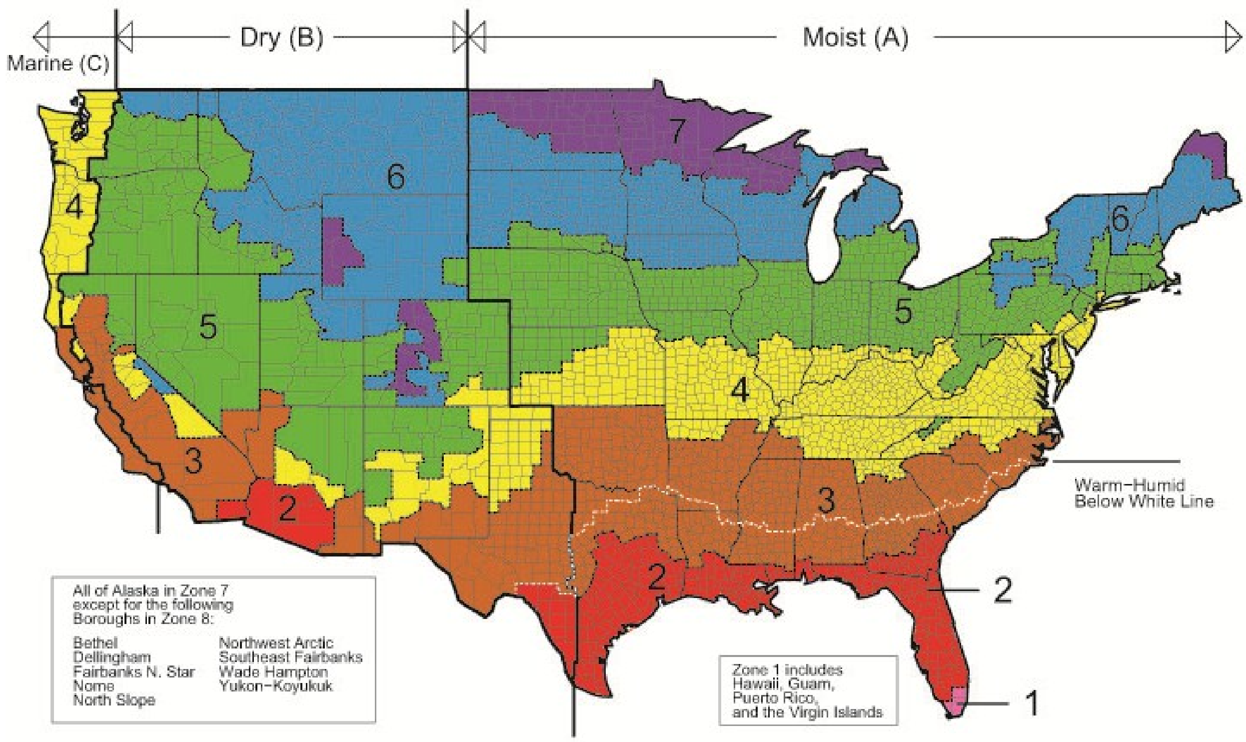

Figure A.2. Climate Zones of the United States

These are the incremental investment costs that PNNL assumed would represent the additional payments to the general contractor and financial institutions to build an average housing unit to the provisions of the 2009 or 2012 IECC rather than to the 2006 IECC. To translate these costs into incremental payments, PNNL (Taylor et al. 2012) made the following assumptions about new home mortgages, which are also used in the current study:

- loan fees equal to 0.7 percent of the mortgage amount
- 30-year loan term, 5-percent interest rate[11]
- 10-percent down payment.

While in specific situations these assumptions may not be accurate, they are broadly representative of conditions in the mortgage industry. The construction sector experiences the investment cost as an increase in final demand; the financial sector receives the loan fees as a positive cash flow that represents an increase in final demand.

Investment payments are made to:

- construction sector: investment cost (+)
- financial sector: 0.7 percent × 90 percent × investment cost (+).

Once incremental payments by building energy code were determined, PNNL used construction permit data at the county level, allocated to the correct climate zone, to determine the effect on weighted average investment spending on a statewide level to meet the 2009 IECC and 2012 IECC. Residential permit data by county was compiled using data from the U.S. Department of Housing and Urban Development (HUD 2012). PNNL chose not to forecast housing starts into the future at this time, but rather used the most current data available to develop weighted average investment costs impacts based on the most recent year of complete data, which was 2010. Table A.2 shows the weighted average investment costs per unit based on the PNNL cost-effectiveness database for a series of state-level reports.[12] About half of the states had adopted the residential provisions of the 2009 IECC residential code or an equivalent code by about August 2012; more than half of these adopted the IECC with modifications. For the states that had adopted the 2009 code or a variant of it, only the cost of moving from the 2009–2012 code matters, so no 2006-2009 or 2006-2012 estimate of the investment impact is shown in Table A.2.

Table A.2. Weighted Average Incremental Residential Investment Costs per Average Unit, 2010 (2011$)

State	2006–2009	2006–2012	2009–2012	State	2006–2009	2006–2012	2009–2012
Alabama	NA	NA	1,891	Nebraska	NA	NA	1,336
Alaska	922‡	4,563	3,641	Nevada	NA	NA	2,427
Arizona	1,317	3,123	1,806	New Hampshire	NA	NA	1,872‡
Arkansas	950	2,709	1,759	New Jersey	NA	NA	1,919‡
California	NA	NA	2,455‡	New Mexico	NA	NA	1,787‡
Colorado	847	2,437	1,599	New York	NA	NA	1,863‡
Connecticut	NA	NA	1,684*	North Carolina	NA	NA	1,759‡
Delaware	NA	NA	2,060*	North Dakota	611	2,615	2,004
Florida	NA	NA	1,609‡	Ohio	NA	NA	1,496
Georgia	NA	NA	2,004‡	Oklahoma	NA	NA	2,437†
Hawaii	1,750‡	3,706	1,957	Oregon	NA	NA	1,910‡
Idaho	NA	NA	1,731*	Pennsylvania	NA	NA	1,759
Illinois	NA	NA	1,599‡	Rhode Island	NA	NA	1,675
Indiana	NA	NA	1,552*	South Carolina	NA	NA	1,985
Iowa	NA	NA	1,627	South Dakota	781	2,813	2,023
Kansas	517*	2,135	1,618	Tennessee	583	2,211	1,627
Kentucky	NA	NA	1,731	Texas	NA	NA	1,665
Louisiana	1,251‡	3,010	1,759	Utah	856	2,437	1,580
Maine	NA	NA	2,531‡	Vermont	NA	NA	2,437*
Maryland	NA	NA	NA	Virginia	NA	NA	2,023†
Massachusetts	NA	NA	1,684	Washington	NA	NA	1,825‡
Michigan	NA	NA	1,787*	West Virginia	677	2,371	1,693
Minnesota	1,185†	3,819	2,634	Wisconsin	NA	NA	2,446†
Mississippi	1,204	3,029	1,825	Wyoming	800	2,992	2,201
Missouri	583	2,408	1,816	Washington D.C.	NA	NA	1,355‡
Montana	NA	NA	2,314‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.
Columns 2006-2009 and 2009-2012 may not add to 2006-2012 due to rounding errors in the underlying data.

The investment impacts can be scaled to any level in any state by simply assuming a level of housing starts in that state. To show how this assumption can affect total impact for a fixed distribution of housing starts across building types, Table A.3 summarizes the permit data used in the calculation of direct investment cost by state for 2010, contrasted with the average annual value for the period 2000-2010.

Table A.3. Number of Residential Units Authorized by Permits by State, 2010, and Average Number 2000-2010

State	2010 Residential Units Authorized	2010-2010 Annual Average Residential Units Authorized	State	2010 Residential Units Authorized	2010-2010 Annual Average Residential Units Authorized
Alabama	11,274	21,503	Nebraska	5,402	8,245
Alaska	840	2,105	Nevada	6,372	30,223
Arizona	12,367	56,924	New Hampshire	2,670	5,940
Arkansas	7,177	11,717	New Jersey	13,535	27,712
California	43,716	133,481	New Mexico	3,689	8,501
Colorado	11,591	36,118	New York	19,565	45,654
Connecticut	3,932	8,407	North Carolina	33,887	74,415
Delaware	3,072	5,540	North Dakota	3,833	3,331
Florida	38,679	155,025	Ohio	13,710	37,271
Georgia	17,358	76,952	Oklahoma	8,140	13,213
Hawaii	3,442	6,038	Oregon	6,783	19,792
Idaho	4,149	12,355	Pennsylvania	19,743	36,784
Illinois	12,318	45,886	Rhode Island	934	2,070
Indiana	13,083	29,932	South Carolina	14,026	34,509
Iowa	7,607	12,560	South Dakota	2,946	4,650
Kansas	5,146	11,712	Tennessee	16,491	33,356
Kentucky	7,965	16,129	Texas	87,736	152,988
Louisiana	11,307	19,032	Utah	9,171	18,876
Maine	2,933	6,097	Vermont	1,319	2,410
Maryland	11,562	22,537	Virginia	15,710	35,971
Massachusetts	9,075	16,511	Washington	20,691	39,064
Michigan	8,994	34,394	West Virginia	2,395	4,387
Minnesota	9,840	27,470	Wisconsin	10,909	28,523
Mississippi	5,259	11,872	Wyoming	2,298	2,833
Missouri	9,441	22,985	Washington D.C.	739	1,448
Montana	2,022	3,370	United States	596,469	1,478,816

Source: HUD 2012.

PNNL multiplied the incremental investment costs for prototype residential buildings by residential housing units authorized by permits (housing starts) for 2010 to calculate statewide costs for the incremental investments that would have been needed to build all new residential buildings to meet the 2009 or 2012 IECC in 2010. The total investment costs needed as a direct result of new code adoption are shown in Table A.4 for the level of housing starts in 2010. Because 2010 was a severely depressed period for the housing market in almost all states, PNNL also calculated Table A.5, which shows the much larger level of incremental investment costs by state for the higher average level of housing starts during the period 2000-2010.

Table A.4. Statewide Incremental Investment Costs to Meet 2009 IECC and 2012 IECC Residential Building Energy Codes by State in 2010

	Statewide Incremental Investment Costs (Thousand 2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	21,318	Nebraska	NA	NA	7,216
Alaska	774‡	3,833	3,058	Nevada	NA	NA	15,465
Arizona	16,288	38,625	22,337	New Hampshire	NA	NA	4,998‡
Arkansas	6,819	19,445	12,626	New Jersey	NA	NA	25,975‡
California	NA	NA	107,337‡	New Mexico	NA	NA	6,594‡
Colorado	9,814	28,241	18,537	New York	NA	NA	36,443‡
Connecticut	NA	NA	6,621*	North Carolina	NA	NA	59,613‡
Delaware	NA	NA	6,329*	North Dakota	2,344	10,024	7,680
Florida	NA	NA	62,221‡	Ohio	NA	NA	20,507
Georgia	NA	NA	34,781‡	Oklahoma	NA	NA	19,833†
Hawaii	6,023‡	12,758	6,735	Oregon	NA	NA	12,953‡
Idaho	NA	NA	7,182*	Pennsylvania	NA	NA	34,731
Illinois	NA	NA	19,700‡	Rhode Island	NA	NA	1,564
Indiana	NA	NA	20,308*	South Carolina	NA	NA	27,841
Iowa	NA	NA	12,380	South Dakota	2,300	8,286	5,959
Kansas	2,663*	10,989	8,327	Tennessee	9,618	36,457	26,839
Kentucky	NA	NA	13,787	Texas	NA	NA	146,089
Louisiana	14,147‡	34,038	19,891	Utah	7,851	22,345	14,494
Maine	NA	NA	7,422‡	Vermont	NA	NA	3,214*
Maryland	NA	NA	NA	Virginia	NA	NA	31,775†
Massachusetts	NA	NA	15,282	Washington	NA	NA	37,762‡
Michigan	NA	NA	16,076*	West Virginia	1,622	5,678	4,056
Minnesota	11,664†	37,583	25,919	Wisconsin	NA	NA	26,682†
Mississippi	6,333	15,930	9,598	Wyoming	1,838	6,875	5,059
Missouri	5,507	22,737	17,141	Washington D.C.	NA	NA	1,001‡
Montana	NA	NA	4,679‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

Table A.5. Statewide Incremental Investment Costs to Meet 2009 IECC and 2012 IECC Residential Building Energy Codes by State at the Average Level of Housing Starts, 2000-2010

	Statewide Incremental Investment Costs (Thousand 2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	40,659	Nebraska	NA	NA	11,014
Alaska	1,941‡	9,604	7,664	Nevada	NA	NA	73,354
Arizona	74,970	177,787	102,817	New Hampshire	NA	NA	11,120‡
Arkansas	11,133	31,745	20,612	New Jersey	NA	NA	53,182‡
California	NA	NA	327,738‡	New Mexico	NA	NA	15,195‡
Colorado	30,580	88,002	57,762	New York	NA	NA	85,038‡
Connecticut	NA	NA	14,157*	North Carolina	NA	NA	130,909‡
Delaware	NA	NA	11,414*	North Dakota	2,037	8,711	6,675
Florida	NA	NA	249,382‡	Ohio	NA	NA	55,749
Georgia	NA	NA	154,194‡	Oklahoma	NA	NA	32,193†
Hawaii	10,565‡	22,380	11,815	Oregon	NA	NA	37,797‡
Idaho	NA	NA	21,386*	Pennsylvania	NA	NA	64,709
Illinois	NA	NA	73,383‡	Rhode Island	NA	NA	3,466
Indiana	NA	NA	46,461*	South Carolina	NA	NA	68,499
Iowa	NA	NA	20,441	South Dakota	3,631	13,079	9,405
Kansas	6,060*	25,011	18,951	Tennessee	19,455	73,741	54,286
Kentucky	NA	NA	27,918	Texas	NA	NA	254,740
Louisiana	23,812‡	57,293	33,481	Utah	16,159	45,991	29,832
Maine	NA	NA	15,429‡	Vermont	NA	NA	5,872*
Maryland	NA	NA	NA	Virginia	NA	NA	72,754†
Massachusetts	NA	NA	27,803	Washington	NA	NA	71,293‡
Michigan	NA	NA	61,476*	West Virginia	2,971	10,400	7,429
Minnesota	32,561†	104,918	72,357	Wisconsin	NA	NA	69,765†
Mississippi	14,296	35,962	21,667	Wyoming	2,265	8,475	6,236
Missouri	13,406	55,354	41,732	Washington D.C.	NA	NA	1,962‡
Montana	NA	NA	7,799‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

The year 2010 and 2000-2010 investment cost values in Table A.4 and Table A.5 equal the increase in short-run payment flow (and final demand) to the construction sector in the given state. For the financial sector, the short-run increase payment flow (final demand) equals 0.7 percent × 90 percent × the 2010 or 2000-2010 average investment cost shown in Table A.4 and Table A.5 for any given state–a relatively minor amount. These two sources of change in final demand were used as inputs for the IMPLAN economic impact model, which calculated the short-term state-level investment-related employment impacts based on state-specific economic data and inter-industry relationships.

A.5 Determine Direct Savings in Energy Expenditures

Over the longer term, new building energy codes will generate energy savings. The reduced expenditures on energy increase consumers' disposable income, a large portion of which is spent in the local economy and can in turn create long-term jobs.

To quantify the value of total residential consumer savings, PNNL multiplied the estimated savings in energy by energy type from the Building Energy Code Program's prototype building models by corresponding state-level fuel prices. Total consumer savings were calculated by multiplying energy savings data for each building type by climate zone in each state, given the appropriate proportion of housing starts of each building type in each climate zone in each state for 2010 (Taylor et al. 2012). Table A.6, Table A.7, and Table A.8 show the estimated mean dollar cost savings for electricity, natural gas, and fuel oil per housing unit in each state that were used to calculate total residential cost savings. This must be done by fuel, because the mix of fuels, end uses, and building types varies by climate zone (Taylor et al. 2012). In addition, fuel prices vary by state. Because many states show only small proportions of some fuels in some end uses, the mean savings per housing unit for a given fuel in a given state can be very small. For example, only the northeastern states have significant amounts of fuel oil heating and only they show significant mean fuel oil savings per housing unit. On the other hand, while a given housing unit in Minnesota actually heated with fuel oil would show significant savings, the small proportion of units heated with fuel oil in Minnesota yields a very small average value for fuel oil savings per housing unit in that state. The savings numbers for each state were multiplied by the estimated permits in each state to calculate total residential cost savings for electricity, natural gas, and fuel oil for that state. The total savings are shown in Appendix B.

Table A.6. Mean Value of Annual Electricity Savings per Housing Unit by State by Building Energy Code Increase

	Mean Value of Annual Electricity Savings per Housing Unit (2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	225	Nebraska	NA	NA	193
Alaska	237‡	827	590	Nevada	NA	NA	201
Arizona	207	371	164	New Hampshire	NA	NA	140‡
Arkansas	113	320	207	New Jersey	NA	NA	232‡
California	NA	NA	88‡	New Mexico	NA	NA	131‡
Colorado	71	185	114	New York	NA	NA	264‡
Connecticut	NA	NA	143*	North Carolina	NA	NA	246‡
Delaware	NA	NA	525*	North Dakota	97	342	245
Florida	NA	NA	157‡	Ohio	NA	NA	129
Georgia	NA	NA	257‡	Oklahoma	NA	NA	295†
Hawaii	346‡	898	552	Oregon	NA	NA	101‡
Idaho	NA	NA	92*	Pennsylvania	NA	NA	214
Illinois	NA	NA	149‡	Rhode Island	NA	NA	127
Indiana	NA	NA	135*	South Carolina	NA	NA	274
Iowa	NA	NA	280	South Dakota	114	378	264
Kansas	106*	347	241	Tennessee	106	341	235
Kentucky	NA	NA	275	Texas	NA	NA	199
Louisiana	133‡	282	149	Utah	65	159	94
Maine	NA	NA	164‡	Vermont	NA	NA	157*
Maryland	NA	NA	NA	Virginia	NA	NA	331†
Massachusetts	NA	NA	116	Washington	NA	NA	101‡
Michigan	NA	NA	220*	West Virginia	119	414	295
Minnesota	91†	428	337	Wisconsin	NA	NA	228†
Mississippi	151	362	211	Wyoming	62	180	118
Missouri	89	289	200	Washington, D.C.	NA	NA	266‡
Montana	NA	NA	117‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

Table A.7. Mean Value of Annual Natural Gas Savings per Housing Unit by State by Building Energy Code Increase

	Mean Value of Annual Natural Gas Savings per Housing Unit (2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	69	Nebraska	NA	NA	129
Alaska	102‡	426	324	Nevada	NA	NA	159
Arizona	22	113	91	New Hampshire	NA	NA	249‡
Arkansas	30	135	105	New Jersey	NA	NA	242‡
California	NA	NA	80‡	New Mexico	NA	NA	157‡
Colorado	49	208	159	New York	NA	NA	266‡
Connecticut	NA	NA	215*	North Carolina	NA	NA	41‡
Delaware	NA	NA	88*	North Dakota	52	218	166
Florida	NA	NA	15‡	Ohio	NA	NA	200
Georgia	NA	NA	49‡	Oklahoma	NA	NA	109†
Hawaii	0‡	0	0	Oregon	NA	NA	160‡
Idaho	NA	NA	195*	Pennsylvania	NA	NA	264
Illinois	NA	NA	166‡	Rhode Island	NA	NA	257
Indiana	NA	NA	188*	South Carolina	NA	NA	41
Iowa	NA	NA	173	South Dakota	54	230	176
Kansas	49*	195	146	Tennessee	17	72	55
Kentucky	NA	NA	73	Texas	NA	NA	53
Louisiana	16‡	75	59	Utah	48	205	157
Maine	NA	NA	340‡	Vermont	NA	NA	340*
Maryland	NA	NA	NA	Virginia	NA	NA	56†
Massachusetts	NA	NA	265	Washington	NA	NA	178‡
Michigan	NA	NA	311*	West Virginia	16	66	50
Minnesota	31†	240	209	Wisconsin	NA	NA	294†
Mississippi	13	58	45	Wyoming	67	285	218
Missouri	52	213	161	Washington, D.C.	NA	NA	40‡
Montana	NA	NA	205‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

Table A.8. Mean Value of Annual Fuel Oil Savings per Housing Unit by State by Building Energy Code Increase

	Mean Value of Annual Fuel Oil Savings per Housing Unit (2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	0	Nebraska	NA	NA	1
Alaska	0‡	3	3	Nevada	NA	NA	1
Arizona	0	0	0	New Hampshire	NA	NA	230‡
Arkansas	0	0	0	New Jersey	NA	NA	30‡
California	NA	NA	0‡	New Mexico	NA	NA	1‡
Colorado	0	1	1	New York	NA	NA	34‡
Connecticut	NA	NA	217*	North Carolina	NA	NA	0‡
Delaware	NA	NA	1*	North Dakota	1	2	1
Florida	NA	NA	1‡	Ohio	NA	NA	3
Georgia	NA	NA	0‡	Oklahoma	NA	NA	0†
Hawaii	0‡	0	0	Oregon	NA	NA	1‡
Idaho	NA	NA	1*	Pennsylvania	NA	NA	37
Illinois	NA	NA	4‡	Rhode Island	NA	NA	244
Indiana	NA	NA	4*	South Carolina	NA	NA	0
Iowa	NA	NA	2	South Dakota	1	3	2
Kansas	0*	1	1	Tennessee	0	0	0
Kentucky	NA	NA	0	Texas	NA	NA	0
Louisiana	0‡	0	0	Utah	1	2	1
Maine	NA	NA	298‡	Vermont	NA	NA	295*
Maryland	NA	NA	NA	Virginia	NA	NA	1†
Massachusetts	NA	NA	243	Washington	NA	NA	1‡
Michigan	NA	NA	5*	West Virginia	0	1	1
Minnesota	1†	2	1	Wisconsin	NA	NA	5†
Mississippi	0	0	0	Wyoming	0	2	2
Missouri	0	2	2	Washington, D.C.	NA	NA	0‡
Montana	NA	NA	2‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

A.6 Determine Consumer Direct Payment Flows from Energy Savings

Calculating energy savings is only the first step in calculating the long-term payment flows associated with building energy codes. While the homeowner enjoys reduced energy costs, at the same time he or she must begin to repay the incremental mortgage and insurance costs and incremental property taxes required for the more efficient but more valuable building. The values and methods for calculating the payment flows were previously used to calculate life-cycle cost and cash flows (Taylor et al. 2012). The estimated consumer payments in this section came from the database underlying that report. Although energy savings are experienced as losses in final demand by the utility and fuel oil supply sectors, they are experienced simultaneously by households, as increases in disposable household income. This increased disposable income is spent by homeowners to pay back the incremental cost of the mortgage and insurance on the more efficient (but more expensive) housing unit, and to pay the incremental property taxes on the more efficient (but more valuable) housing unit. Therefore, the finance, insurance, and state and local government sectors experience an increase in final demand. Finally, adjusted for income tax deductions at the federal and state level, the remaining disposable income is assumed to be spent like any other income in the rest of the economy, which also experiences an increase in final demand in the IMPLAN model.

In fact, as the housing stock expands over time, the value of savings expands with it. While the short-term economic effects occur only in the year of construction, the longer-term effects of the energy savings persist as long as the more efficient stock remains in the housing inventory and expand with the size of the accumulated efficient housing stock.

Much of this spending will occur outside of the state. The IMPLAN methodology compensates by allowing for a spending "leakage" out of the state economy in the form of imported goods and services. This is because not all energy savings necessarily would be spent locally. For example, any expenditures of household savings on out-of-state catalog- and internet-based purchases, out-of-state shopping, and expenditures while on out-of-state travel would not cause an increase in in-state final demand. The direction of the impact on in-state final demand is shown below as "+," "-," or "0."

1. Energy savings by households:

   electric utility sales (-), natural gas utility sales (-), fuel oil supplier sales (-)

2. Payments by households (a + b + c + d must sum to energy savings):

   a. to financial sector: 90 percent × investment cost (+) × annualization factor for 30-year mortgage at 5 percent

   b. to insurance sector: mortgage insurance, an amount that varies locally but is between 6.6 percent and 9.6 percent of the mortgage payment

   c. to state and local government: property tax rate (assumed to be 0.9 percent) × investment cost × (1 - income tax rate) (+)

   d. to other in-state final demand: locally spent portion of (energy savings - payments for mortgage, insurance, and property taxes, less deductions) (+)

   e. to other out-of-state final demand: IMPLAN only counts the local component of final demand for the state forecast (0).

The sources of change in final demand (items 1, 2a, 2b, 2c, and 2d in the list above) were used as inputs for the IMPLAN economic impact model. This model was used to calculate the long-term state-level employment impacts based on state-specific economic data and inter-industry relationships from any one year of housing sales that meet the newer editions of building energy codes. These components of long-term consumer payments out of energy savings are fed into IMPLAN final demand, and then IMPLAN calculates the resulting long-term direct, indirect, and induced employment impacts. Table A.9 through Table A.12 show the average per-unit cost for incremental mortgage cost, property taxes, and insurance, and the offsetting value of tax savings from deductibility.

Table A.9. Average Incremental Mortgage Payments per Housing Unit to Meet the 2009 and 2012 IECC Building Energy Codes

	Average Incremental Mortgage Payments Per Housing Unit (2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	109	Nebraska	NA	NA	77
Alaska	53‡	263	210	Nevada	NA	NA	140
Arizona	76	180	104	New Hampshire	NA	NA	108‡
Arkansas	55	156	101	New Jersey	NA	NA	110‡
California	NA	NA	141‡	New Mexico	NA	NA	103‡
Colorado	49	141	92	New York	NA	NA	107‡
Connecticut	NA	NA	97*	North Carolina	NA	NA	101‡
Delaware	NA	NA	119*	North Dakota	35	151	115
Florida	NA	NA	93‡	Ohio	NA	NA	86
Georgia	NA	NA	116‡	Oklahoma	NA	NA	140†
Hawaii	101‡	214	113	Oregon	NA	NA	110‡
Idaho	NA	NA	100*	Pennsylvania	NA	NA	101
Illinois	NA	NA	92‡	Rhode Island	NA	NA	97
Indiana	NA	NA	89*	South Carolina	NA	NA	114
Iowa	NA	NA	94	South Dakota	45	162	117
Kansas	30*	123	93	Tennessee	34	127	94
Kentucky	NA	NA	100	Texas	NA	NA	96
Louisiana	72‡	174	102	Utah	49	140	91
Maine	NA	NA	146‡	Vermont	NA	NA	141*
Maryland	NA	NA	NA	Virginia	NA	NA	117†
Massachusetts	NA	NA	97	Washington	NA	NA	105‡
Michigan	NA	NA	103*	West Virginia	39	137	98
Minnesota	68†	220	152	Wisconsin	NA	NA	141†
Mississippi	69	175	105	Wyoming	46	172	127
Missouri	34	138	105	Washington D.C.	NA	NA	78‡
Montana	NA	NA	133‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

Table A.10. Average Incremental Property Tax Payments per Housing Unit to Meet the 2009 and 2012 IECC Building Energy Codes

Average Incremental Property Tax Payments Per Housing Unit (2011$)							
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	17	Nebraska	NA	NA	12
Alaska	8‡	41	33	Nevada	NA	NA	22
Arizona	12	28	16	New Hampshire	NA	NA	17‡
Arkansas	9	25	16	New Jersey	NA	NA	17‡
California	NA	NA	22‡	New Mexico	NA	NA	16‡
Colorado	8	22	15	New York	NA	NA	17‡
Connecticut	NA	NA	15*	North Carolina	NA	NA	16‡
Delaware	NA	NA	19*	North Dakota	6	24	18
Florida	NA	NA	15‡	Ohio	NA	NA	14
Georgia	NA	NA	18‡	Oklahoma	NA	NA	22†
Hawaii	16‡	34	18	Oregon	NA	NA	17‡
Idaho	NA	NA	16*	Pennsylvania	NA	NA	16
Illinois	NA	NA	15‡	Rhode Island	NA	NA	15
Indiana	NA	NA	14*	South Carolina	NA	NA	18
Iowa	NA	NA	15	South Dakota	7	26	18
Kansas	5*	19	15	Tennessee	5	20	15
Kentucky	NA	NA	16	Texas	NA	NA	15
Louisiana	11‡	27	16	Utah	8	22	14
Maine	NA	NA	23‡	Vermont	NA	NA	22*
Maryland	NA	NA	NA	Virginia	NA	NA	18†
Massachusetts	NA	NA	15	Washington	NA	NA	17‡
Michigan	NA	NA	16*	West Virginia	6	22	15
Minnesota	11†	35	24	Wisconsin	NA	NA	22†
Mississippi	11	28	17	Wyoming	7	27	20
Missouri	5	22	17	Washington D.C.	NA	NA	12‡
Montana	NA	NA	21‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

Table A.11. Average Incremental Insurance Payments per Housing Unit to Meet the 2009 and 2012 IECC Building Energy Codes

	Average Incremental Insurance Payments Per Housing Unit (2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	9	Nebraska	NA	NA	6
Alaska	4‡	21	17	Nevada	NA	NA	11
Arizona	6	15	8	New Hampshire	NA	NA	9‡
Arkansas	4	13	8	New Jersey	NA	NA	9‡
California	NA	NA	11‡	New Mexico	NA	NA	8‡
Colorado	4	11	7	New York	NA	NA	9‡
Connecticut	NA	NA	8*	North Carolina	NA	NA	8‡
Delaware	NA	NA	10*	North Dakota	3	12	9
Florida	NA	NA	7‡	Ohio	NA	NA	7
Georgia	NA	NA	9‡	Oklahoma	NA	NA	11†
Hawaii	8‡	17	9	Oregon	NA	NA	9‡
Idaho	NA	NA	8*	Pennsylvania	NA	NA	8
Illinois	NA	NA	7‡	Rhode Island	NA	NA	8
Indiana	NA	NA	7*	South Carolina	NA	NA	9
Iowa	NA	NA	8	South Dakota	4	13	9
Kansas	2*	10	8	Tennessee	3	10	8
Kentucky	NA	NA	8	Texas	NA	NA	8
Louisiana	6‡	14	8	Utah	4	11	7
Maine	NA	NA	12‡	Vermont	NA	NA	11*
Maryland	NA	NA	NA	Virginia	NA	NA	9†
Massachusetts	NA	NA	8	Washington	NA	NA	8‡
Michigan	NA	NA	8*	West Virginia	3	11	8
Minnesota	6†	18	12	Wisconsin	NA	NA	11†
Mississippi	6	14	8	Wyoming	4	14	10
Missouri	3	11	8	Washington D.C.	NA	NA	6‡
Montana	NA	NA	11‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

Table A.12. Average Incremental Tax Deductions per Housing Unit to Meet the 2009 and 2012 IECC Building Energy Codes

Average Incremental Tax Deductions Per Housing Unit (2011$)							
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	25	Nebraska	NA	NA	19
Alaska	10‡	51	40	Nevada	NA	NA	27
Arizona	17	40	23	New Hampshire	NA	NA	21‡
Arkansas	14	38	25	New Jersey	NA	NA	24‡
California	NA	NA	37‡	New Mexico	NA	NA	24‡
Colorado	11	32	21	New York	NA	NA	26‡
Connecticut	NA	NA	23*	North Carolina	NA	NA	25‡
Delaware	NA	NA	29*	North Dakota	7	32	25
Florida	NA	NA	18‡	Ohio	NA	NA	19
Georgia	NA	NA	28‡	Oklahoma	NA	NA	33†
Hawaii	26‡	55	29	Oregon	NA	NA	29‡
Idaho	NA	NA	25*	Pennsylvania	NA	NA	22
Illinois	NA	NA	21‡	Rhode Island	NA	NA	22
Indiana	NA	NA	19*	South Carolina	NA	NA	28
Iowa	NA	NA	25	South Dakota	9	31	22
Kansas	7*	30	22	Tennessee	7	24	18
Kentucky	NA	NA	24	Texas	NA	NA	18
Louisiana	17‡	41	24	Utah	11	32	21
Maine	NA	NA	NA‡	Vermont	NA	NA	34*
Maryland	NA	NA	23	Virginia	NA	NA	28†
Massachusetts	NA	NA	23	Washington	NA	NA	20‡
Michigan	NA	NA	23*	West Virginia	9	33	24
Minnesota	17†	54	37	Wisconsin	NA	NA	34†
Mississippi	16	40	24	Wyoming	9	33	24
Missouri	8	33	25	Washington D.C.	NA	NA	20‡
Montana	NA	NA	33‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

A.7 Conclusion

PNNL determined total employment and labor income impacts of implementing the residential provisions of the 2009 and 2012 IECC building energy codes in each analyzed state by aggregating all three categories of job creation (direct, indirect, induced) produced by the IMPLAN input-output model of the state's economy. The inputs for the IMPLAN model runs were estimated for all states by analyzing data used by PNNL to calculate the cost-effectiveness in 2010 of building energy code upgrades from the 2006 IECC to the 2009 version, from the 2006 to the 2012 version, and from the 2009 to the 2012 version as applicable to residential buildings. PNNL used the cost-effectiveness data to calculate short-term and long-term financial flows associated with each edition of the IECC in each state, reported in Appendix B. Because 2010 was a depressed year in the housing market of nearly every state, and therefore likely was not representative of "normal" conditions in the housing market, PNNL not only calculated impacts for 2010 level of housing starts but also for the average of the period 2000-2010, a more representative time period. The total employment impacts appear in Table 2 in the main report. For more information on building energy codes, please visit www.energycodes.gov.

A.8 References

DOE – U.S. Department of Energy. 2012. *National Energy and Cost Savings for New Single- and Multifamily Homes: A Comparison of the 2006, 2009, and 2012 Editions of the International Energy Conservation Code*. Building Energy Codes Program, Washington, D.C.

HUD – U.S. Department of Housing and Urban Development. 2012. *SOCDS Building Permits Database*. Washington, D.C. Accessed June 9, 2012 at http://socds.huduser.org/permits/help.htm.

Taylor ZT, N Fernandez, and RG Lucas. 2012. *Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes*. PNNL-21294, Pacific Northwest National Laboratory, Richland, Washington. Accessed June 9, 2012 at http://www.energycodes.gov/sites/default/files/documents/residential_methodology.pdf.

[1] While the impacts are not covered in the report, the building energy codes also apply to some elements of residential additions, renovations, and alterations.

[2] Final demand (also sometimes known as final use) is a term in economics referring to household consumption, government consumption and investment, private investment, and exports. In modeling an economy, changes in final demand (e.g., an increase in the demand for housing), leads to production of goods and services to satisfy that demand and to additional direct and indirect economic activity.

[3] Figure A.1 shows the typical homeowner and single family, cooperative, or condominium situation, where the homeowner both takes out a mortgage to build the house (or equivalently, takes out a mortgage to buy the housing unit from the developer), bears the cost of subsequent mortgage payments, and pays any energy bills. In the rental situation, the building owner uses rental payments to retire the mortgage and pay property taxes, and the renter pays the energy bills directly or indirectly through the rental payment or a "condo fee." From an economic impact perspective, the payments go to approximately the same places—the construction costs, the financial and insurance costs, energy suppliers, and state and local government. Any energy savings after these costs are paid are available to the homeowner or renter to purchase other goods and services. The differences in impact between the owner and renter situation are minor and have been ignored.

[4] Where necessary, the original published analysis was augmented with additional engineering judgments made by PNNL staff engineers in support of the cost-effectiveness study.

[5] The methods in Taylor et al. used three heating fuels and that method has been carried over to this report. The energy cost savings in this study would have been slightly higher if liquefied petroleum gasses (LPG) had been included, since LPG is generally more expensive than fuel oil on a per-Btu basis.

[6] The assumption here is that the additional investment in the housing unit will be reflected at cost in its assessed value.

[7] PNNL recognizes that some consumer expenditures may be made in states other than the home state. The economic model used in this study accounts for these economic leakages as spending on "imports."

[8] PNNL assumed that the initial impact would be on local suppliers.

[9] IMPLAN Version 3.0. Hudson, WI: MIG, Inc. Computer software.

[10] This requires the purchase of MIG's input-output data set for the region of interest.

[11] We are aware that some of the housing units constructed may be covered by programs under the U.S. Department of Housing and Urban Development, the Farmers Home Administration, the U.S. Department of Veterans Affairs, and other federal agencies as well as state agencies that may have more stringent energy efficiency criteria and/or different financing considerations. Those were not broken out here because the energy efficiency criteria are generally over and above minimum state or local codes, and the focus of this report is on the benefits associated with meeting the minimum code. In addition, special financing considerations would not substantively change the overall

payment flows although they may divide responsibility for payment between the homeowner or renter and a government agency. Five percent is a higher rate than current mortgage rates in early 2013, but is consistent with plausible longer-term averages for inflation-adjusted mortgage rates of 3.0 to 3.5 percent and target inflation rates of about 1.5 to 2.0 percent.

[12] The reports are posted to the DOE Building Energy Codes Program website at http://www.energycodes.gov/development/residential/iecc_analysis/.

Appendix B

Long-Term Statewide Savings and Cost Data

Appendix B

Long-Term Statewide Savings and Cost Data

Pacific Northwest National Laboratory (PNNL) estimated the overall statewide level of costs and savings experienced from meeting the 2009 International Energy Conservation Code (IECC) as applicable to residential buildings and 2012 IECC Residential Provisions by multiplying cost and savings data for average housing units in each state by corresponding numbers of residential housing starts from Table A.3. This appendix contains the statewide values.

In section B.1, Table B.1 through Table B.3 show the value of statewide energy savings by energy type for the 2010 level of housing starts. Section B.2 reports the corresponding long-term consumer payments to final demand out of those savings in Table B.4 through Table B.7. In section B.3, Table B.8 through Table B.10 show the value of statewide energy savings by energy type at the 2000-2010 average level of housing starts. Section B.4 reports the corresponding long-term consumer payments to final demand out of those savings in Table B.11 through Table B.14.

B.1 Long-Term Value of Energy Savings at 2010 Level of Housing Starts

Table B.1. Statewide Value of Annual Electricity Savings per Housing Unit by State by Building Energy Code Increase, 2010 Level of Housing Starts

	Statewide Value of Annual Electricity Savings (Thousand 2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	2,537	Nebraska	NA	NA	1,043
Alaska	199‡	695	496	Nevada	NA	NA	1,281
Arizona	2,560	4,588	2,028	New Hampshire	NA	NA	374‡
Arkansas	811	2,297	1,486	New Jersey	NA	NA	3,140‡
California	NA	NA	3,847‡	New Mexico	NA	NA	483‡
Colorado	823	2,144	1,321	New York	NA	NA	5,165‡
Connecticut	NA	NA	562*	North Carolina	NA	NA	8,336‡
Delaware	NA	NA	1,613*	North Dakota	372	1,311	939
Florida	NA	NA	6,073‡	Ohio	NA	NA	1,769
Georgia	NA	NA	4,461‡	Oklahoma	NA	NA	2,401†
Hawaii	1,191‡	3,091	1,900	Oregon	NA	NA	685‡
Idaho	NA	NA	382*	Pennsylvania	NA	NA	4,225
Illinois	NA	NA	1,835‡	Rhode Island	NA	NA	119
Indiana	NA	NA	1,766*	South Carolina	NA	NA	3,843
Iowa	NA	NA	2,130	South Dakota	336	1,114	778
Kansas	545*	1,786	1,240	Tennessee	1,748	5,623	3,875
Kentucky	NA	NA	2,190	Texas	NA	NA	17,459
Louisiana	1,504‡	3,189	1,685	Utah	596	1,458	862
Maine	NA	NA	481‡	Vermont	NA	NA	207*
Maryland	NA	NA	NA	Virginia	NA	NA	5,200†
Massachusetts	NA	NA	1,053	Washington	NA	NA	2,090‡
Michigan	NA	NA	1,979*	West Virginia	285	992	707
Minnesota	895†	4,212	3,316	Wisconsin	NA	NA	2,487†
Mississippi	794	1,904	1,110	Wyoming	142	414	271
Missouri	840	2,728	1,888	Washington, D.C.	NA	NA	197‡
Montana	NA	NA	237‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

Table B.2. Statewide Value of Annual Natural Gas Savings by State by Building Energy Code Increase, 2010 Level of Housing Starts

	Statewide Value of Annual Natural Gas Savings (Thousand 2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	778	Nebraska	NA	NA	697
Alaska	86‡	358	272	Nevada	NA	NA	1,013
Arizona	272	1,397	1,125	New Hampshire	NA	NA	665‡
Arkansas	215	969	754	New Jersey	NA	NA	3,275‡
California	NA	NA	3,497‡	New Mexico	NA	NA	579‡
Colorado	568	2,411	1,843	New York	NA	NA	5,204‡
Connecticut	NA	NA	845*	North Carolina	NA	NA	1,389‡
Delaware	NA	NA	270*	North Dakota	199	836	636
Florida	NA	NA	580‡	Ohio	NA	NA	2,742
Georgia	NA	NA	851‡	Oklahoma	NA	NA	887†
Hawaii	0‡	0	0	Oregon	NA	NA	1,085‡
Idaho	NA	NA	809*	Pennsylvania	NA	NA	5,212
Illinois	NA	NA	2,045‡	Rhode Island	NA	NA	240
Indiana	NA	NA	2,460*	South Carolina	NA	NA	575
Iowa	NA	NA	1,316	South Dakota	159	678	518
Kansas	252*	1,003	751	Tennessee	280	1,187	907
Kentucky	NA	NA	581	Texas	NA	NA	4,650
Louisiana	181‡	848	667	Utah	440	1,880	1,440
Maine	NA	NA	997‡	Vermont	NA	NA	448*
Maryland	NA	NA	NA	Virginia	NA	NA	880†
Massachusetts	NA	NA	2,405	Washington	NA	NA	3,683‡
Michigan	NA	NA	2,797*	West Virginia	38	158	120
Minnesota	305†	2,362	2,057	Wisconsin	NA	NA	3,207†
Mississippi	68	305	237	Wyoming	154	655	501
Missouri	491	2,011	1,520	Washington, D.C.	NA	NA	30‡
Montana	NA	NA	415‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

Table B.3. Statewide Value of Annual Fuel Oil Savings by State by Building Energy Code Increase, 2010 Level of Housing Starts

	Statewide Value of Annual Fuel Oil Savings (Thousand 2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	0	Nebraska	NA	NA	5
Alaska	0‡	3	3	Nevada	NA	NA	6
Arizona	0	0	0	New Hampshire	NA	NA	614‡
Arkansas	0	0	0	New Jersey	NA	NA	406‡
California	NA	NA	0‡	New Mexico	NA	NA	4‡
Colorado	0	12	12	New York	NA	NA	665‡
Connecticut	NA	NA	853*	North Carolina	NA	NA	0‡
Delaware	NA	NA	3*	North Dakota	4	8	4
Florida	NA	NA	39‡	Ohio	NA	NA	41
Georgia	NA	NA	0‡	Oklahoma	NA	NA	0†
Hawaii	0‡	0	0	Oregon	NA	NA	7‡
Idaho	NA	NA	4*	Pennsylvania	NA	NA	730
Illinois	NA	NA	49‡	Rhode Island	NA	NA	228
Indiana	NA	NA	52*	South Carolina	NA	NA	0
Iowa	NA	NA	15	South Dakota	3	9	6
Kansas	0*	5	5	Tennessee	0	0	0
Kentucky	NA	NA	0	Texas	NA	NA	0
Louisiana	0‡	0	0	Utah	9	18	9
Maine	NA	NA	874‡	Vermont	NA	NA	389*
Maryland	NA	NA	NA	Virginia	NA	NA	16†
Massachusetts	NA	NA	2,205	Washington	NA	NA	21‡
Michigan	NA	NA	45*	West Virginia	0	2	2
Minnesota	10†	20	10	Wisconsin	NA	NA	55†
Mississippi	0	0	0	Wyoming	0	5	5
Missouri	0	19	19	Washington, D.C.	NA	NA	0‡
Montana	NA	NA	4‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

B.2 Long-Term Consumer Spending of Energy Savings at 2010 Level of Housing Starts

Table B.4. Statewide Incremental Mortgage Payments to Meet the 2009 and 2012 IECC Building Energy Codes, Housing Starts Equal to 2010 Level

	Statewide Incremental Mortgage Payments (Thousand 2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	1,229	Nebraska	NA	NA	416
Alaska	45‡	221	176	Nevada	NA	NA	892
Arizona	940	2,226	1,286	New Hampshire	NA	NA	288‡
Arkansas	395	1,120	725	New Jersey	NA	NA	1,489‡
California	NA	NA	6,164‡	New Mexico	NA	NA	380‡
Colorado	568	1,634	1,066	New York	NA	NA	2,093‡
Connecticut	NA	NA	381*	North Carolina	NA	NA	3,423‡
Delaware	NA	NA	366*	North Dakota	134	579	441
Florida	NA	NA	3,597‡	Ohio	NA	NA	1,179
Georgia	NA	NA	2,014‡	Oklahoma	NA	NA	1,140†
Hawaii	348‡	737	389	Oregon	NA	NA	746‡
Idaho	NA	NA	415*	Pennsylvania	NA	NA	1,994
Illinois	NA	NA	1,133‡	Rhode Island	NA	NA	91
Indiana	NA	NA	1,164*	South Carolina	NA	NA	1,599
Iowa	NA	NA	715	South Dakota	133	477	345
Kansas	154*	633	479	Tennessee	561	2,094	1,550
Kentucky	NA	NA	797	Texas	NA	NA	8,423
Louisiana	814‡	1,967	1,153	Utah	449	1,284	835
Maine	NA	NA	428‡	Vermont	NA	NA	186*
Maryland	NA	NA	NA	Virginia	NA	NA	1,838†
Massachusetts	NA	NA	880	Washington	NA	NA	2,173‡
Michigan	NA	NA	926*	West Virginia	93	328	235
Minnesota	669†	2,165	1,496	Wisconsin	NA	NA	1,538†
Mississippi	363	920	552	Wyoming	106	395	292
Missouri	321	1,303	991	Washington D.C.	NA	NA	58‡
Montana	NA	NA	269‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

Table B.5. Statewide Incremental Property Tax Payments to Meet the 2009 and 2012 IECC Building Energy Codes, Housing Starts Equal to 2010 Level

	Statewide Incremental Property Tax Payments (Thousand 2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	192	Nebraska	NA	NA	65
Alaska	7‡	34	28	Nevada	NA	NA	140
Arizona	148	346	198	New Hampshire	NA	NA	45‡
Arkansas	65	179	115	New Jersey	NA	NA	230‡
California	NA	NA	962‡	New Mexico	NA	NA	59‡
Colorado	93	255	174	New York	NA	NA	333‡
Connecticut	NA	NA	59*	North Carolina	NA	NA	542‡
Delaware	NA	NA	58*	North Dakota	23	92	69
Florida	NA	NA	580‡	Ohio	NA	NA	192
Georgia	NA	NA	312‡	Oklahoma	NA	NA	179†
Hawaii	55‡	117	62	Oregon	NA	NA	115‡
Idaho	NA	NA	66*	Pennsylvania	NA	NA	316
Illinois	NA	NA	185‡	Rhode Island	NA	NA	14
Indiana	NA	NA	183*	South Carolina	NA	NA	252
Iowa	NA	NA	114	South Dakota	21	77	53
Kansas	26*	98	77	Tennessee	82	330	247
Kentucky	NA	NA	127	Texas	NA	NA	1,316
Louisiana	124‡	305	181	Utah	73	202	128
Maine	NA	NA	67‡	Vermont	NA	NA	29*
Maryland	NA	NA	NA	Virginia	NA	NA	283†
Massachusetts	NA	NA	136	Washington	NA	NA	352‡
Michigan	NA	NA	144*	West Virginia	14	53	36
Minnesota	108†	344	236	Wisconsin	NA	NA	240†
Mississippi	58	147	89	Wyoming	16	62	46
Missouri	47	208	160	Washington D.C.	NA	NA	9‡
Montana	NA	NA	42‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

Table B.6. Statewide Incremental Insurance Payments to Meet the 2009 and 2012 IECC Building Energy Codes, Housing Starts Equal to 2010 Level

	Statewide Incremental Insurance Payments (Thousand 2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	101	Nebraska	NA	NA	32
Alaska	3‡	18	14	Nevada	NA	NA	70
Arizona	74	186	99	New Hampshire	NA	NA	24‡
Arkansas	29	93	57	New Jersey	NA	NA	122‡
California	NA	NA	481‡	New Mexico	NA	NA	30‡
Colorado	46	128	81	New York	NA	NA	176‡
Connecticut	NA	NA	31*	North Carolina	NA	NA	271‡
Delaware	NA	NA	31*	North Dakota	11	46	34
Florida	NA	NA	271‡	Ohio	NA	NA	96
Georgia	NA	NA	156‡	Oklahoma	NA	NA	90†
Hawaii	28‡	59	31	Oregon	NA	NA	61‡
Idaho	NA	NA	33*	Pennsylvania	NA	NA	158
Illinois	NA	NA	86‡	Rhode Island	NA	NA	7
Indiana	NA	NA	92*	South Carolina	NA	NA	126
Iowa	NA	NA	61	South Dakota	12	38	27
Kansas	10*	51	41	Tennessee	49	165	132
Kentucky	NA	NA	64	Texas	NA	NA	702
Louisiana	68‡	158	90	Utah	37	101	64
Maine	NA	NA	35‡	Vermont	NA	NA	15*
Maryland	NA	NA	NA	Virginia	NA	NA	141†
Massachusetts	NA	NA	73	Washington	NA	NA	166‡
Michigan	NA	NA	72*	West Virginia	7	26	19
Minnesota	59†	177	118	Wisconsin	NA	NA	120†
Mississippi	32	74	42	Wyoming	9	32	23
Missouri	28	104	76	Washington D.C.	NA	NA	4‡
Montana	NA	NA	22‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
* State code slightly amends IECC code. Analysis used IECC.
†State code amends IECC. Custom state cost-effectiveness and custom analysis in this report.
‡State code amends IECC. No custom analysis available. Analysis used IECC.

Table B.7. Other Statewide Consumer Spending Out of Energy Savings from Meeting the 2009 and 2012 IECC Building Energy Codes, Housing Starts Equal to 2010 Level

Other Statewide Consumer Spending Out of Energy Savings (Thousand 2011$)							
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	2,074	Nebraska	NA	NA	1,345
Alaska	239‡	821	580	Nevada	NA	NA	1,364
Arizona	1,905	3,747	1,855	New Hampshire	NA	NA	1,143‡
Arkansas	667	2,225	1,572	New Jersey	NA	NA	5,400‡
California	NA	NA	1,268‡	New Mexico	NA	NA	682‡
Colorado	800	2,898	2,086	New York	NA	NA	9,137‡
Connecticut	NA	NA	1,876*	North Carolina	NA	NA	5,862‡
Delaware	NA	NA	1,527*	North Dakota	429	1,552	1,127
Florida	NA	NA	2,940‡	Ohio	NA	NA	3,318
Georgia	NA	NA	3,315‡	Oklahoma	NA	NA	2,182†
Hawaii	854‡	2,365	1,511	Oregon	NA	NA	712‡
Idaho	NA	NA	772*	Pennsylvania	NA	NA	8,134
Illinois	NA	NA	2,710‡	Rhode Island	NA	NA	496
Indiana	NA	NA	3,048*	South Carolina	NA	NA	2,497
Iowa	NA	NA	2,754	South Dakota	356	1,293	940
Kansas	643*	2,166	1,513	Tennessee	1,451	4,650	3,183
Kentucky	NA	NA	1,983	Texas	NA	NA	13,862
Louisiana	871‡	2,080	1,210	Utah	569	2,036	1,467
Maine	NA	NA	1,927‡	Vermont	NA	NA	860*
Maryland	NA	NA	NA	Virginia	NA	NA	4,273†
Massachusetts	NA	NA	4,755	Washington	NA	NA	3,517‡
Michigan	NA	NA	3,849*	West Virginia	230	821	594
Minnesota	531†	4,428	3,897	Wisconsin	NA	NA	4,178†
Mississippi	494	1,288	799	Wyoming	191	657	464
Missouri	1,029	3,484	2,445	Washington D.C.	NA	NA	168‡
Montana	NA	NA	378‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
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‡State code amends IECC. No custom analysis available. Analysis used IECC.

B.3 Long-Term Value of Energy Savings at the 2000-2010 Average Level of Housing Starts

Table B.8. Statewide Value of Annual Electricity Savings per Housing Unit by State by Building Energy Code Upgrade, 2000-2010 Average Level of Housing Starts

	Statewide Value of Annual Electricity Savings (Thousand 2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	4,838	Nebraska	NA	NA	1,591
Alaska	499‡	1,741	1,242	Nevada	NA	NA	6,075
Arizona	11,783	21,119	9,336	New Hampshire	NA	NA	832‡
Arkansas	1,324	3,749	2,425	New Jersey	NA	NA	6,429‡
California	NA	NA	11,746‡	New Mexico	NA	NA	1,114‡
Colorado	2,564	6,682	4,117	New York	NA	NA	12,053‡
Connecticut	NA	NA	1,202*	North Carolina	NA	NA	18,306‡
Delaware	NA	NA	2,909*	North Dakota	323	1,139	816
Florida	NA	NA	24,339‡	Ohio	NA	NA	4,808
Georgia	NA	NA	19,777‡	Oklahoma	NA	NA	3,898†
Hawaii	2,089‡	5,422	3,333	Oregon	NA	NA	1,999‡
Idaho	NA	NA	1,137*	Pennsylvania	NA	NA	7,872
Illinois	NA	NA	6,837‡	Rhode Island	NA	NA	263
Indiana	NA	NA	4,041*	South Carolina	NA	NA	9,455
Iowa	NA	NA	3,517	South Dakota	530	1,758	1,228
Kansas	1,241*	4,064	2,823	Tennessee	3,536	11,374	7,839
Kentucky	NA	NA	4,435	Texas	NA	NA	30,445
Louisiana	2,531‡	5,367	2,836	Utah	1,227	3,001	1,774
Maine	NA	NA	1,000‡	Vermont	NA	NA	378*
Maryland	NA	NA	NA	Virginia	NA	NA	11,906†
Massachusetts	NA	NA	1,915	Washington	NA	NA	3,945‡
Michigan	NA	NA	7,567*	West Virginia	522	1,816	1,294
Minnesota	2,500†	11,757	9,257	Wisconsin	NA	NA	6,503†
Mississippi	1,793	4,298	2,505	Wyoming	176	510	334
Missouri	2,046	6,643	4,597	Washington, D.C.	NA	NA	385‡
Montana	NA	NA	394‡				

Source: PNNL Cost-Effectiveness Database.
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Table B.9. Statewide Value of Annual Natural Gas Savings by State by Building Energy Code Upgrade, 2000-2010 Average Level of Housing Starts

	Statewide Value of Annual Natural Gas Savings (Thousand 2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	1,484	Nebraska	NA	NA	1,064
Alaska	215‡	897	682	Nevada	NA	NA	4,805
Arizona	1,252	6,432	5,180	New Hampshire	NA	NA	1,479‡
Arkansas	352	1,582	1,230	New Jersey	NA	NA	6,706‡
California	NA	NA	10,678‡	New Mexico	NA	NA	1,335‡
Colorado	1,770	7,513	5,743	New York	NA	NA	12,144‡
Connecticut	NA	NA	1,808*	North Carolina	NA	NA	3,051‡
Delaware	NA	NA	488*	North Dakota	173	726	553
Florida	NA	NA	2,325‡	Ohio	NA	NA	7,454
Georgia	NA	NA	3,771‡	Oklahoma	NA	NA	1,440†
Hawaii	0‡	0	0	Oregon	NA	NA	3,167‡
Idaho	NA	NA	2,409*	Pennsylvania	NA	NA	9,711
Illinois	NA	NA	7,617‡	Rhode Island	NA	NA	532
Indiana	NA	NA	5,627*	South Carolina	NA	NA	1,415
Iowa	NA	NA	2,173	South Dakota	251	1,070	818
Kansas	574*	2,284	1,710	Tennessee	567	2,402	1,835
Kentucky	NA	NA	1,177	Texas	NA	NA	8,108
Louisiana	305‡	1,427	1,123	Utah	906	3,870	2,964
Maine	NA	NA	2,073‡	Vermont	NA	NA	819*
Maryland	NA	NA	NA	Virginia	NA	NA	2,014†
Massachusetts	NA	NA	4,375	Washington	NA	NA	6,953‡
Michigan	NA	NA	10,697*	West Virginia	70	290	219
Minnesota	852†	6,593	5,741	Wisconsin	NA	NA	8,386†
Mississippi	154	689	534	Wyoming	190	807	618
Missouri	1,195	4,896	3,701	Washington, D.C.	NA	NA	58‡
Montana	NA	NA	691‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
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Table B.10. Statewide Value of Annual Fuel Oil Savings by State by Building Energy Code Upgrade, 2000-2010 Average Level of Housing Starts

Statewide Value of Annual Fuel Oil Savings (Thousand 2011$)							
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	0	Nebraska	NA	NA	8
Alaska	0‡	6	6	Nevada	NA	NA	30
Arizona	0	0	0	New Hampshire	NA	NA	1,366‡
Arkansas	0	0	0	New Jersey	NA	NA	831‡
California	NA	NA	0‡	New Mexico	NA	NA	9‡
Colorado	0	36	36	New York	NA	NA	1,552‡
Connecticut	NA	NA	1,824*	North Carolina	NA	NA	0‡
Delaware	NA	NA	6*	North Dakota	3	7	3
Florida	NA	NA	155‡	Ohio	NA	NA	112
Georgia	NA	NA	0‡	Oklahoma	NA	NA	0†
Hawaii	0‡	0	0	Oregon	NA	NA	20‡
Idaho	NA	NA	12*	Pennsylvania	NA	NA	1,361
Illinois	NA	NA	184‡	Rhode Island	NA	NA	505
Indiana	NA	NA	120*	South Carolina	NA	NA	0
Iowa	NA	NA	25	South Dakota	5	14	9
Kansas	0*	12	12	Tennessee	0	0	0
Kentucky	NA	NA	0	Texas	NA	NA	0
Louisiana	0‡	0	0	Utah	19	38	19
Maine	NA	NA	1,817‡	Vermont	NA	NA	711*
Maryland	NA	NA	NA	Virginia	NA	NA	36†
Massachusetts	NA	NA	4,012	Washington	NA	NA	39‡
Michigan	NA	NA	172*	West Virginia	0	4	4
Minnesota	27†	55	27	Wisconsin	NA	NA	143†
Mississippi	0	0	0	Wyoming	0	6	6
Missouri	0	46	46	Washington, D.C.	NA	NA	0‡
Montana	NA	NA	7‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
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B.4 Long-Term Consumer Spending of Energy Savings at the 2000-2010 Average Level of Housing Starts

Table B.11. Statewide Incremental Mortgage Payments to Meet the 2009 and 2012 IECC Building Energy Codes, Housing Starts Equal to Average Level 2000-2010

	Statewide Incremental Mortgage Payments (Thousand 2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	2,344	Nebraska	NA	NA	635
Alaska	112‡	554	442	Nevada	NA	NA	4,231
Arizona	4,326	10,246	5,920	New Hampshire	NA	NA	642‡
Arkansas	644	1,828	1,183	New Jersey	NA	NA	3,048‡
California	NA	NA	18,821‡	New Mexico	NA	NA	876‡
Colorado	1,770	5,093	3,323	New York	NA	NA	4,885‡
Connecticut	NA	NA	815*	North Carolina	NA	NA	7,516‡
Delaware	NA	NA	659*	North Dakota	117	503	383
Florida	NA	NA	14,417‡	Ohio	NA	NA	3,205
Georgia	NA	NA	8,926‡	Oklahoma	NA	NA	1,850†
Hawaii	610‡	1,292	682	Oregon	NA	NA	2,177‡
Idaho	NA	NA	1,236*	Pennsylvania	NA	NA	3,715
Illinois	NA	NA	4,222‡	Rhode Island	NA	NA	201
Indiana	NA	NA	2,664*	South Carolina	NA	NA	3,934
Iowa	NA	NA	1,181	South Dakota	209	753	544
Kansas	351*	1,441	1,089	Tennessee	1,134	4,236	3,135
Kentucky	NA	NA	1,613	Texas	NA	NA	14,687
Louisiana	1,370‡	3,312	1,941	Utah	925	2,643	1,718
Maine	NA	NA	890‡	Vermont	NA	NA	340*
Maryland	NA	NA	NA	Virginia	NA	NA	4,209†
Massachusetts	NA	NA	1,602	Washington	NA	NA	4,102‡
Michigan	NA	NA	3,543*	West Virginia	171	601	430
Minnesota	1,868†	6,043	4,175	Wisconsin	NA	NA	4,022†
Mississippi	819	2,078	1,247	Wyoming	130	487	360
Missouri	781	3,172	2,413	Washington D.C.	NA	NA	113‡
Montana	NA	NA	448‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
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Table B.12. Statewide Incremental Property Tax Payments to Meet the 2009 and 2012 IECC Building Energy Codes, Housing Starts Equal to Average Level 2000-2010

Statewide Incremental Insurance Payments (Thousand 2011$)							
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	366	Nebraska	NA	NA	99
Alaska	17‡	86	69	Nevada	NA	NA	665
Arizona	683	1,594	911	New Hampshire	NA	NA	101‡
Arkansas	105	293	187	New Jersey	NA	NA	471‡
California	NA	NA	2,937‡	New Mexico	NA	NA	136‡
Colorado	289	795	542	New York	NA	NA	776‡
Connecticut	NA	NA	126*	North Carolina	NA	NA	1,191‡
Delaware	NA	NA	105*	North Dakota	20	80	60
Florida	NA	NA	2,325‡	Ohio	NA	NA	522
Georgia	NA	NA	1,385‡	Oklahoma	NA	NA	291†
Hawaii	97‡	205	109	Oregon	NA	NA	336‡
Idaho	NA	NA	198*	Pennsylvania	NA	NA	589
Illinois	NA	NA	688‡	Rhode Island	NA	NA	31
Indiana	NA	NA	419*	South Carolina	NA	NA	621
Iowa	NA	NA	188	South Dakota	33	121	84
Kansas	59*	223	176	Tennessee	167	667	500
Kentucky	NA	NA	258	Texas	NA	NA	2,295
Louisiana	209‡	514	305	Utah	151	415	264
Maine	NA	NA	140‡	Vermont	NA	NA	53*
Maryland	NA	NA	NA	Virginia	NA	NA	647†
Massachusetts	NA	NA	248	Washington	NA	NA	664‡
Michigan	NA	NA	550*	West Virginia	26	97	66
Minnesota	302†	961	659	Wisconsin	NA	NA	628†
Mississippi	131	332	202	Wyoming	20	76	57
Missouri	115	506	391	Washington D.C.	NA	NA	17‡
Montana	NA	NA	71‡				

Source: PNNL Cost-Effectiveness Database.
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Table B.13. Statewide Incremental Insurance Payments to Meet the 2009 and 2012 IECC Building Energy Codes, Housing Starts Equal to Average Level 2000-2010

	Statewide Incremental Insurance Payments (Thousand 2011$)						
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	194	Nebraska	NA	NA	49
Alaska	8‡	44	36	Nevada	NA	NA	332
Arizona	342	854	455	New Hampshire	NA	NA	53‡
Arkansas	47	152	94	New Jersey	NA	NA	249‡
California	NA	NA	1,468‡	New Mexico	NA	NA	68‡
Colorado	144	397	253	New York	NA	NA	411‡
Connecticut	NA	NA	67*	North Carolina	NA	NA	595‡
Delaware	NA	NA	55*	North Dakota	10	40	30
Florida	NA	NA	1,085‡	Ohio	NA	NA	261
Georgia	NA	NA	693‡	Oklahoma	NA	NA	145†
Hawaii	48‡	103	54	Oregon	NA	NA	178‡
Idaho	NA	NA	99*	Pennsylvania	NA	NA	294
Illinois	NA	NA	321‡	Rhode Island	NA	NA	17
Indiana	NA	NA	210*	South Carolina	NA	NA	311
Iowa	NA	NA	100	South Dakota	19	60	42
Kansas	23*	117	94	Tennessee	100	334	267
Kentucky	NA	NA	129	Texas	NA	NA	1,224
Louisiana	114‡	266	152	Utah	76	208	132
Maine	NA	NA	73‡	Vermont	NA	NA	27*
Maryland	NA	NA	NA	Virginia	NA	NA	324†
Massachusetts	NA	NA	132	Washington	NA	NA	313‡
Michigan	NA	NA	275*	West Virginia	13	48	35
Minnesota	165†	494	330	Wisconsin	NA	NA	314†
Mississippi	71	166	95	Wyoming	11	40	28
Missouri	69	253	184	Washington D.C.	NA	NA	9‡
Montana	NA	NA	37‡				

Source: PNNL Cost-Effectiveness Database.
NA – not applicable. State already has adopted 2009 IECC or equivalent (Maryland has adopted 2012).
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Table B.14. Other Statewide Consumer Spending Out of Energy Savings from Meeting the 2009 and 2012 IECC Building Energy Codes, Housing Starts Equal to Average Level 2000-2010

Other Statewide Consumer Spending Out of Energy Savings (Thousand 2011$)							
State	**2006–2009**	**2006–2012**	**2009–2012**	**State**	**2006–2009**	**2006–2012**	**2009–2012**
Alabama	NA	NA	3,957	Nebraska	NA	NA	2,053
Alaska	600‡	2,057	1,455	Nevada	NA	NA	6,468
Arizona	8,766	17,248	8,539	New Hampshire	NA	NA	2,542‡
Arkansas	1,090	3,632	2,566	New Jersey	NA	NA	11,057‡
California	NA	NA	3,871‡	New Mexico	NA	NA	1,573‡
Colorado	2,492	9,030	6,501	New York	NA	NA	21,320‡
Connecticut	NA	NA	4,010*	North Carolina	NA	NA	12,874‡
Delaware	NA	NA	2,753*	North Dakota	373	1,349	979
Florida	NA	NA	11,782‡	Ohio	NA	NA	9,020
Georgia	NA	NA	14,698‡	Oklahoma	NA	NA	3,541†
Hawaii	1,497‡	4,148	2,651	Oregon	NA	NA	2,078‡
Idaho	NA	NA	2,298*	Pennsylvania	NA	NA	15,155
Illinois	NA	NA	10,095‡	Rhode Island	NA	NA	1,099
Indiana	NA	NA	6,974*	South Carolina	NA	NA	6,143
Iowa	NA	NA	4,547	South Dakota	563	2,041	1,483
Kansas	1,464*	4,931	3,443	Tennessee	2,935	9,406	6,438
Kentucky	NA	NA	4,016	Texas	NA	NA	24,172
Louisiana	1,465‡	3,502	2,036	Utah	1,170	4,190	3,020
Maine	NA	NA	4,006‡	Vermont	NA	NA	1,571*
Maryland	NA	NA	NA	Virginia	NA	NA	9,784†
Massachusetts	NA	NA	8,652	Washington	NA	NA	6,641‡
Michigan	NA	NA	14,721*	West Virginia	421	1,505	1,088
Minnesota	1,483†	12,362	10,878	Wisconsin	NA	NA	10,924†
Mississippi	1,116	2,909	1,805	Wyoming	235	810	572
Missouri	2,505	8,481	5,953	Washington D.C.	NA	NA	330‡
Montana	NA	NA	630‡				

Source: PNNL Cost-Effectiveness Database.
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