U.S. DEPARTMENT OF ENERGY

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

Final Report

MJ Scott
JM Niemeyer

September 2013

Pacific Northwest
NATIONAL LABORATORY

Proudly Operated by Battelle *Since 1965*

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor Battelle Memorial Institute, nor any of their employees, makes **any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights**. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or Battelle Memorial Institute. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC05-76RL01830

Printed in the United States of America

Available to DOE and DOE contractors from the
Office of Scientific and Technical Information,
P.O. Box 62, Oak Ridge, TN 37831-0062;
ph: (865) 576-8401
fax: (865) 576-5728
email: reports@adonis.osti.gov

Available to the public from the National Technical Information Service
5301 Shawnee Rd., Alexandria, VA 22312
ph: (800) 553-NTIS (6847)
email: orders@ntis.gov <http://www.ntis.gov/about/form.aspx>
Online ordering: http://www.ntis.gov

This document was printed on recycled paper.
(8/2010)

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

Final Report

MJ Scott
JM Niemeyer

September 2013

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

Pacific Northwest National Laboratory
Richland, Washington 99352

Contents

1.0 Introduction 1

1.1 Summary of Results 1

2.0 Analysis 3

3.0 References 5

Appendix A–A Method to Estimate Job Creation Potential in States as a Result of Enhanced Building Energy Code Adoption A.1

Appendix B–Long-Term Statewide Savings and Cost Data B.1

Figures

A.1 Changes in Payment Flows Associated with More Energy-Efficient Residential Building Energy Codes A.2

A.2 Climate Zones of the United States A.6

Tables

1 Investments and Other Cash Flows in the Nevada Economy Associated with Upgrading the Residential Building Energy Code: Inputs to the IMPLAN Model 4

2 Potential Economic Impact in the Nevada Economy Associated with Upgrading the Residential Building Energy Code: Jobs and Labor Income 4

A.1 Incremental Investment from More Efficient Building Energy Codes by U.S. Climate Zone A.6

A.2 Weighted Average Incremental Residential Investment Costs per Average Unit, 2010 ..... A.8

A.3 Number of Residential Units Authorized by Permits by State, 2010, and Average Number 2000-2010 ..... A.9

A.4 Statewide Incremental Investment Costs to Meet 2009 IECC and 2012 IECC Residential Building Energy Codes by State in Mil A.10

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 ..... A.11

A.6 Mean Value of Annual Electricity Savings per Housing Unit by State by Building Energy Code Increase A.13

A.7 Mean Value of Annual Natural Gas Savings per Housing Unit by State by Building Energy Code Increase A.14

A.8 Mean Value of Annual Fuel Oil Savings per Housing Unit by State by Building Energy Code Increase A.15

by building permits each year in every state and the District of Columbia. Units authorized include 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 Nevada in 2010 about 17 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 5 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 Nevada. 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.

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. Nevada Energy and Cost Savings for New Single– and Multifamily Homes: 2012 IECC as Compared to the 2009 IECC. Building Energy Codes Program, Washington, D.C. Accessed April 30, 2013 at: http://www.energycodes.gov/sites/default/files/documents/NevadaResidentialCostEffectiveness.pdf

---

[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 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 (e.g., 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 (e.g., 2012 IECC) from energy use complying with the baseline code (e.g., 2009 IECC or other existing code currently in effect). 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] 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.

[10] 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.

[11] 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

estimates of changes in potential short-term and long-term overall economic activity in the Nevada 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.[11]

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

	IECC 2009 to IECC 2012	
Item and Direction of Impact on Economy (+ or -)	**2010 Housing Starts**	**2000-2010 Average Housing Starts**
Housing Starts	6,372	30,223
Short Term (Thousand 2011$):		
Construction (+)	15,465	73,354
Finance Fees (+)	104	491
Annual Long Term (Thousand 2011$):		
Mortgage Repayments (+)	892	4,231
Insurance (+)	70	332
Property Taxes (+)	140	665
Other Consumption (+)	1,364	6,468
Electricity Sales (-)	1,281	6,075
Natural Gas Sales (-)	1,013	4,805
Fuel Oil Sales (-)	6	30

Table 2. Potential Economic Impact in the Nevada 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	6,372	30,223
	Short-Term Impacts	
Jobs	180	850
Labor Income (Million 2011$)	10	46
	Annual Long-Term Impacts	
Jobs	15	75
Labor Income (Million 2011$)	<0.5	2

2.0 Analysis

To calculate the impact of implementing an upgraded residential building energy code in Nevada, 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 Nevada that are compliant with the 2012 IECC Residential Provisions.[9] 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 Nevada 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 Nevada 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.[10] 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 Nevada economy associated with an upgrade of the residential building energy code from the current level to the 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

$0.4 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. Nevada could see up to 205 indirect new jobs and $9 million in labor income in the short term and support for about 30 jobs and $1 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. Nevada could see up to 245 induced jobs and $10 million in the short term, and support for about 10 jobs and $0.4 million per year in the long term as a result of induced economic activity.

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, including Nevada. Between the years 2000 and 2010, Nevada built an average of nearly 30,200 new housing units per year.[4] Even in the depressed building climate of 2010, the state still constructed over 6,400 new units. At the higher "typical" rate of construction, each year class of code-compliant construction in Nevada would support up to an additional 850 short-term jobs and up to an additional $46 million in short-term labor income per year. In the long term, in addition to saving Nevada consumers $11 million per year thereafter, each year class would annually provide support for up to 75 jobs and $2 million in labor income in the state's economy.[5]

The long-term impact is likely to be much greater than this, however. A constant rate of residential construction merely maintains the level of short-term impact because it depends on one-time additions to the stock of incrementally more efficient buildings. The segment of housing units affected by the upgraded[6] 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. 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 850 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 75 + 75 + 75 = 225 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, Nevada could see approximately 400 new jobs and $27 million in labor income as a result of direct job creation. Energy savings would sustain about 35 direct jobs and

A.9 Average Incremental Mortgage Payments per Housing Unit to Meet the 2009 and 2012 IECC Building Energy Codes A.17
A.10 Average Incremental Property Tax Payments per Housing Unit to Meet the 2009 and 2012 IECC Building Energy Codes A.18
A.11 Average Incremental Insurance Payments per Housing Unit to Meet the 2009 and 2012 IECC Building Energy Codes A.19
A.12 Average Incremental Tax Deductions per Housing Unit to Meet the 2009 and 2012 IECC Building Energy Codes A.20
B.1 Statewide Value of Annual Electricity Savings per Housing Unit by State by Building Energy Code Increase, 2010 Level of Housing Starts B.2
B.2 Statewide Value of Annual Natural Gas Savings by State by Building Energy Code Increase, 2010 Level of Housing Starts B.3
B.3 Statewide Value of Annual Fuel Oil Savings by State by Building Energy Code Increase, 2010 Level of Housing Starts B.4
B.4 Statewide Incremental Mortgage Payments to Meet the 2009 and 2012 IECC Building Energy Codes, Housing Starts Equal to 2010 Level B.5
B.5 Statewide Incremental Property Tax Payments to Meet the 2009 and 2012 IECC Building Energy Codes, Housing Starts Equal to 2010 Level B.6
B.6 Statewide Incremental Insurance Payments to Meet the 2009 and 2012 IECC Building Energy Codes, Housing Starts Equal to 2010 Level B.7
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 B.8
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 B.9
B.9 Statewide Value of Annual Natural Gas Savings by State by Building Energy Code Upgrade, 2000-2010 Average Level of Housing Starts B.10
B.10 Statewide Value of Annual Fuel Oil Savings by State by Building Energy Code Upgrade, 2000-2010 Average Level of Housing Starts B.11
B.11 Statewide Incremental Mortgage Payments to Meet the 2009 and 2012 IECC Building Energy Codes, Housing Starts Equal to Average Level 2000-2010 ..... B.12
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 ..... B.13
B.13 Statewide Incremental Insurance Payments to Meet the 2009 and 2012 IECC Building Energy Codes, Housing Starts Equal to Average Level 2000-2010 ..... B.14
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 ..... B.15