



November 30, 2011
REPORT #E11-232

Northwest Residential Code Savings for Idaho, Montana and Washington

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Date: 3/01/2011
To: Aaron James, Northwest Energy Efficiency Alliance
From: Ben Larson and Virginia Mugford, Ecotope
Re: NW Residential Code Savings Contract #: 40320

Overview

Ecotope has completed a final estimate of the site energy savings realized in 2010 for new Idaho, Washington, and Montana houses. Houses built in 2010 under the code effective in each state for 2010 were evaluated and compared to results for the same houses built under the previously effective code. The relevant codes were as follows:

Table 1. State by State Code History and Savings Estimate.

| State | Code in 2010 | Previous Code | Savings |
|------------|------------------------|-----------------------|---------|
| Idaho | IECC 2006 | IECC 2003 | 1.8% |
| Washington | WSEC 2006 | WSEC 2003 | 4.6% |
| Montana | IECC 2003 w/ MT amend. | MEC 1996 w/ MT amend. | 7.4% |

Using census¹ data and other sources² to characterize the three states' new construction markets, the analysis showed how much less energy would be consumed by houses built in 2010 to the code in force, as compared to the previously effective code. The energy end-uses considered in the house were space heating, space cooling, ventilation, domestic water heating, and lighting. Ecotope's analysis shows a predicted three-state savings of 4.2% from code improvements (accounting only for heating, cooling, ventilation, lighting, and water heating energy use). In energy terms, this amounts to a total savings of about 4,704 MWh (537 average kW) and 732,483 therms for the approximately 27,000 housing units expected to be completed in 2010.

This memo explains the methodology and results for the code analysis of Idaho, Washington and Montana. It contains the deliverables for Tasks 1, 2 and 3.

¹ <http://censtats.census.gov/bldg/bldgprmt.shtml>

² Single-Family Residential New Construction Characteristics and Practices Study. March 27, 2007. Prepared for Northwest Energy Efficiency Alliance by RLW Analytics. <http://neea.org/research/reportdetail.aspx?ID=191>

Multi-Family Residential New Construction Characteristics and Practices Study. June 14, 2007. Prepared for Northwest Energy Efficiency Alliance by RLW Analytics. <http://neea.org/research/reportdetail.aspx?ID=193>

Idaho, Washington and Montana Code Savings 2010

The analysis approach used here is the same methodology approved by the Regional Technical Forum to estimate savings of the proposed 2011 ORSC³. Where necessary, it has been adapted to suit the investigated codes. Broadly, the analysis methodology is to develop a representative set of prototypical houses whose energy use can be estimated through simulation tools. These representative characteristics include climate, single or multi-family occupancy, house size, ground contact type (slab, crawl, or basement), and heating system type. Since we are analyzing the 2010 construction year, we used the same housing stock characteristics for both the old and in-force codes. The housing population consists of the number and geographic distribution of houses specific to 2010 within each state.

Energy Use Calculations

The building energy use was predicted by a combination of numerical simulations and engineering calculations. SEEM (Simplified Energy and Enthalpy Model) was used to simulate heating, cooling, and ventilation energy use. The program combines building shell characteristics, thermostat settings, occupant behavior inputs, descriptions of heating and cooling systems, and duct distribution efficiency to develop an overall estimate of energy requirements of a house. Additionally, engineering calculations calibrated by field studies were employed to determine the energy use for lighting and water heating. Lighting energy calculations were done using a lighting power density method corresponding to the level of regular and high efficacy lights required by the codes. This method assumes all lamps in the house operate 1.5 hours per day throughout the year⁴. Water heating energy was calibrated to the equivalent of 22 gals per day per occupant. Occupancy varies with house size and construction type (either single family or multi-family).

Importantly, this analysis includes only regulated loads: space heating and cooling, water heating, lighting and ventilation. Loads not regulated by the code, including appliances and plug loads are excluded from the analysis. Since they are not regulated, there will be no savings from them year over year due to code changes. Ventilation, while not specifically regulated, is included because it is part of our standard energy-use modeling suite. No savings are attributed to ventilation savings but they do contribute to the total predicted energy use of the home.

SEEM (version 0.93), the residential energy-simulation program used for the analysis was developed by and for the Northwest Power and Conservation Council and the Northwest Energy Efficiency Alliance (NEEA), and written by Larry Palmiter of Ecotope. It is the simulation engine used to provide heating and cooling energy savings estimates for the residential sector in the Northwest Power Plan, for the Performance Tested Comfort System (PTCS) incentive program, as well as numerous other utility program offerings. SEEM is also used extensively to support state building energy code revisions including, most recently, the revised Washington State Energy Code and Oregon Residential Specialty Code.

The SEEM program consists of an hourly thermal simulation and an hourly moisture (humidity) simulation that interact with ducts, equipment, building shell and weather parameters to calculate the space conditioning requirements of the building. It is based on algorithms consistent with current American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE), American Heating and Refrigeration Institute (AHRI), and International Organization for Standards (ISO) calculation standards. The simulation generates outputs used in this analysis; they include building heat

³ RTF Meeting 9/2010. <http://www.nwcouncil.org/energy/rtf/meetings/2010/09/Default.htm>

⁴ RTF Meeting 9/2010: <http://www.nwcouncil.org/energy/rtf/meetings/2010/09/Default.htm>

loss (UA), heating equipment input energy, and cooling equipment input energy.

The weather files used in all savings simulations are composite TMY weather files corresponding to the heating and cooling climate zones assigned to each Northwest county by the Regional Technical Forum (RTF).⁵

Four distinct building prototypes were used in the SEEM simulations: a 1344 ft² (square foot) ranch style home, a 2200 ft² split level home, a 2688 ft² home with a full conditioned basement, and 952 ft² unit in an eight-unit townhouse structure. These are standard analytical prototypes used by the Northwest Power and Conservation Council to develop and evaluate energy forecasts and conservation plans for the region's utilities. The 952 ft² prototype is a special case in this analysis which represents multifamily construction. The state codes regulate multifamily structures three stories or less which the 952 ft² prototype represents well. This type of construction has many shared walls so the overall heating load per unit is less than for a single family detached dwelling.

Estimation of 2010 New Building Stock

At the time of this analysis, monthly housing starts census data for 13 of the 139 state counties were available for January through December of 2010.

Table 2. Counties Reporting 2010 Housing Starts by State.

| State | Reporting Counties | Total Counties |
|------------|--------------------|----------------|
| Idaho | 5 | 44 |
| Washington | 6 | 39 |
| Montana | 2 | 56 |

The totals covering all counties in 2010 will be available in May 2011. In lieu of these totals, we conducted an estimate of the 2010 totals based upon the known data from 2010, scaling it in proportion to 2009 data. The total number of units estimated to be built in 2010 is 27,123 (21,578 single family units and 5,545 multifamily units). Throughout the analysis, the single family units are detached structures while the multifamily units come eight to a building. The breakdown by state is as follows:

Table 3. Housing Start Estimates by State.

| State | Single Family | Multifamily (units) | Total |
|------------|---------------|---------------------|-------|
| Idaho | 4042 | 421 | 4463 |
| Washington | 16299 | 4923 | 21222 |
| Montana | 1238 | 200 | 1438 |

* Note that in Montana, only the housing starts in the 23 counties served by NEEA utilities were totaled above and evaluated in the code analysis, although all Montana counties were used in determining the ratio for housing allocation in 2010.

The total yearly figures for every county in each state were available for 2009. Using the 2009 and 2010 datasets, the expected total new single family housing stock for 2010 was estimated as follows.

The counties for which no 2010 data was available were estimated based upon their 2009 figures. A ratio

⁵ <http://www.nwcouncil.org/energy/rtf/zones/zonemapsx.htm>

between each state's characterized county totals in 2009 and the entire statewide 2009 total was determined and used to extrapolate total 2010 total housing starts, based upon the 2010 subtotals for the known counties. The percentage of housing starts in each county during 2009 over the 2009 state total was then determined. Using this ratio, the extrapolated 2010 total was apportioned to each county in the state following the 2009 distribution. These extrapolated totals were then compared to historical behavior for each state, and it was noted that while distributions in Montana remained consistent with historical figures, multifamily housing starts increased drastically and were highly variable in urban Washington and Idaho counties in 2010. Multifamily starts were noted to have varied widely from year to year in these states, however, applying 2010 behavior in known counties to all counties' 2009 ratios resulted in multifamily housing increases of three times any historical figure in these states. The best prediction of current multifamily housing starts behavior in rural counties was assumed to be rural counties' past behavior and not present behavior of urban counties, and so the 2009 multifamily figures were used for all counties in Idaho and Washington that did not report monthly data in 2010.

The estimated new housing in each county was assigned to an appropriate representative heating and cooling climate zone combination as designated by the Regional Technical Forum.⁶

Savings from New Building Construction

The history of change to each state's building codes is outlined by the US Department of Energy⁷ in the state's "BACKGROUND/HISTORY" section. In general, code changes include prescribed improvements of envelope insulation as well as lighting, heating and cooling efficiency. While insulation requirements changed in each evaluated code cycle, lighting was not regulated in the state codes considered in this analysis. Regulation of residential lighting does not start to occur until the 2008 OR, 2010 WA, and 2009 IECC codes. Lighting power density was therefore calculated using an assumption of zero percent high efficiency lighting (CFLs). Heating and cooling system efficiencies did change with code adoptions in each state; however, these codes are superseded by the National Appliance Energy Conservation Act (NAECA) which required HSPF 7.7 / SEER 13 or better and AFUE of 0.78 or better in 2010. These federal standards are not attributable to state code improvements, and so heating and cooling efficiencies were held constant at 2010 federal levels in all analyses. Water heater efficiency standards are similarly regulated under NAECA. Likewise, the federal requirements for water heating equipment in 2010 were used in the analysis. The changes in each code cycle due to envelope improvements were thus the only source of energy savings in each state. A summary of these envelope changes by state is included in Table 4.

⁶ Ibid.

⁷ <http://www.energycodes.gov/states/>

Table 4. State by State Code Mandated Envelope Insulation.

| Envelope Component | Idaho | | Washington | | Montana | |
|---------------------------------|-----------|-----------|------------|-----------|----------------------|----------|
| | IECC 2006 | IECC 2003 | WSEC 2006 | WSEC 2003 | IECC 2003 | MEC 1996 |
| Glazing U-value | 0.35 | 0.35 | 0.35 | 0.35-0.40 | 0.35 | 0.4 |
| Door U-value | 0.70 | 0.70 | 0.20 | 0.46 | 0.35 | .5 |
| Ceiling insulation* | R-45.74* | R-40.67* | R-38 | R-38 | R-38 Adv Rsd Heel | R-38 |
| Wall Insulation* | R-19 | R-20.1* | R-21 | R-19 | R-21 | R-19 |
| Floor Insulation | R-30 | R-21 | R-30 | R-30 | R-21 | R-19 |
| Slab Insulation | R-10 | R-10 | U-0.36 | U-0.54 | R-19 | R-19 |
| Basement Wall Insulation | R-13 | R-10 | R-15 | R-10 | R-11 | R-10 |

* A change in the IECC climate zones classifications for Idaho counties between 2003 and 2006 necessitated the calculation of a composite insulation value here. See discussion below.

With adoption of the 2006 IECC, Idaho counties were redistricted into less detailed climate zone assignments. This redistricting reduced wall insulation requirements in many counties. To account for this unusual circumstance, net weighted insulation values for ceilings and walls were calculated and are included above. These weighted values take into account the county based climate assignment, the insulation level for that climate and the number of houses built in each county in 2010. As seen above, there was a net loss in wall insulation due to this reclassification of climate zones. Effective ceiling insulation increased under this change; however ceilings represent both a smaller percentage of house area exposed to heat loss, and a diminishing return in terms of effectiveness of increased insulation at these high R values. This net loss in insulation is reflected in the lower code savings results for Idaho state.

A side by side comparison of energy use in each state under the existing and previous code follows. Idaho realized the least energy savings from code improvements, at 1.8%. Idaho showed the least savings due to the net loss of insulation value under climate rezoning. Washington's energy savings was 4.6%. Montana realized a savings of 7.4%, a larger value that reflects the gap of approximately nine years between the two code changes in this state.

Table 5. Idaho Statewide Residential 2010 New Construction Energy Use IECC 2006/IECC 2003

| Idaho | IECC 2006 Code | | | IECC 2003 Code | | |
|---------------------------------|----------------|----------------|--------------|----------------|----------------|--------------|
| | Gas (therms) | Electric (kWh) | Total (kBtu) | Gas (therms) | Electric (kWh) | Total (kBtu) |
| State Total | 3,359,826 | 26,820,138 | 427,492,873 | 3,427,957 | 27,040,833 | 435,059,042 |
| Per ft² Built | 0.374 | 2.989 | 47.645 | 0.382 | 3.014 | 48.488 |
| Per Unit Built | 753 | 6,009 | 95,775 | 768 | 6,058 | 97,471 |

Table 6. Idaho Site Energy Savings for 2010 New Construction IECC 2006/IECC 2003

| Idaho | Gas (therms) | Electric (kWh) | Total (kBtu) |
|---------------------------------|--------------|----------------|--------------|
| State Total | 68,132 | 220,695 | 7,566,169 |
| Per ft² Built | 0.008 | 0.025 | 0.843 |
| Per Unit Built | 15 | 49 | 1,695 |
| % Savings | 2.0% | 0.8% | 1.8% |

Table 7. Washington Statewide Residential 2010 New Construction Site Energy Use WSEC 2006/WSEC 2003

| Washington | WSEC 2006 Code | | | WSEC 2003 Code | | |
|---------------------------------|----------------|----------------|---------------|----------------|----------------|---------------|
| | Gas (therms) | Electric (kWh) | Total (kBtu) | Gas (therms) | Electric (kWh) | Total (kBtu) |
| State Total | 11,037,993 | 124,137,724 | 1,527,357,260 | 11,607,782 | 127,907,990 | 1,597,200,232 |
| Per ft² Built | 0.281 | 3.163 | 38.918 | 0.296 | 3.259 | 40.698 |
| Per Unit Built | 520 | 5,850 | 71,971 | 547 | 6,027 | 75,262 |

Table 8. Washington Site Energy Savings for 2010 New Construction WSEC 2006/WSEC 2003

| Washington | Gas (therms) | Electric (kWh) | Total (kBtu) |
|---------------------------------|--------------|----------------|--------------|
| State Total | 569,788 | 3,770,266 | 69,842,972 |
| Per ft² Built | 0.015 | 0.096 | 1.780 |
| Per Unit Built | 27 | 178 | 3,291 |
| % Savings | 5.2% | 3.0% | 4.6% |

Table 9. Montana Statewide Residential 2010 New Construction Site Energy Use IECC 2003/MEC 1996

| Montana | IECC 2003 Code | | | MEC 1996 Code | | |
|---------------------------------|----------------|----------------|--------------|---------------|----------------|--------------|
| | Gas (therms) | Electric (kWh) | Total (kBtu) | Gas (therms) | Electric (kWh) | Total (kBtu) |
| State Total | 1,287,479 | 9,249,092 | 160,305,853 | 1,382,043 | 9,961,988 | 172,194,552 |
| Per ft² Built | 0.457 | 3.285 | 56.931 | 0.491 | 3.538 | 61.153 |
| Per Unit Built | 895 | 6,431 | 111,469 | 961 | 6,927 | 119,736 |

Table 10. Montana Site Energy Savings for 2010 New Construction IECC 2003/MEC 1996

| Montana | Gas (therms) | Electric (kWh) | Total (kBtu) |
|---------------------------------|--------------|----------------|--------------|
| State Total | 94,563 | 712,895 | 11,888,699 |
| Per ft² Built | 0.034 | 0.253 | 4.222 |
| Per Unit Built | 66 | 496 | 8,267 |
| % Savings | 7.3% | 7.7% | 7.4% |

Formulas for State Code Calculations: Idaho, Washington and Montana

The state-wide energy use for houses built under either code can be calculated on a square-foot or unit construction basis using the information from Tables 5, 7, & 9 for Idaho, Washington, and Montana Respectively. These formulas will be particularly useful if the total housing starts reported for 2010 (expected announcement in May 2011) differ substantially from our predictions. In that case, a new total energy use can be calculated by using the new total number of units built in 2010. This assumes the distribution of houses by climate remains similar between predicted and reported value, which, given the way in which we determined the distribution is likely to be the case

Idaho

2003 Code Energy Use Formulas:

$$0.382 \text{ therms/ft}^2 * \text{Total New Construction Area (ft}^2) = \text{Total therms in 2010}$$

$$3.014 \text{ kWh/ft}^2 * \text{Total New Construction Area (ft}^2) = \text{Total kWh in 2010}$$

$$768 \text{ therms/unit} * \text{Total Number of Units Built} = \text{Total therms in 2010}$$

$$6,058 \text{ kWh/unit} * \text{Total Number of Units Built} = \text{Total kWh in 2010}$$

2006 Code Energy Use Formulas:

$$0.374 \text{ therms/ft}^2 * \text{Total New Construction Area (ft}^2) = \text{Total therms in 2010}$$

$$2.989 \text{ kWh/ft}^2 * \text{Total New Construction Area (ft}^2) = \text{Total kWh in 2010}$$

$$753 \text{ therms/unit} * \text{Total Number of Units Built} = \text{Total therms in 2010}$$

$$6,009 \text{ kWh/unit} * \text{Total Number of Units Built} = \text{Total kWh in 2010}$$

Washington

2003 Code Energy Use Formulas:

0.296 therms/ ft² * Total New Construction Area (ft²) = Total therms in 2010

3.259 kWh/ ft² * Total New Construction Area (ft²) = Total kWh in 2010

547 therms/unit * Total Number of Units Built = Total therms in 2010

6,027kWh/unit * Total Number of Units Built = Total kWh in 2010

2006 Code Energy Use Formulas:

0.281 therms/ ft² * Total New Construction Area (ft²) = Total therms in 2010

3.163 kWh/ ft² * Total New Construction Area (ft²) = Total kWh in 2010

520 therms/unit * Total Number of Units Built = Total therms in 2010

5,850 kWh/unit * Total Number of Units Built = Total kWh in 2010

Montana

1996 Code Energy Use Formulas:

0.491 therms/ ft² * Total New Construction Area (ft²) = Total therms in 2010

3.538 kWh/ ft² * Total New Construction Area (ft²) = Total kWh in 2010

961 therms/unit * Total Number of Units Built = Total therms in 2010

6,927 kWh/unit * Total Number of Units Built = Total kWh in 2010

2003 Code Energy Use Formulas:

0.457 therms/ ft² * Total New Construction Area (ft²) = Total therms in 2010

3.285 kWh/ ft² * Total New Construction Area (ft²) = Total kWh in 2010

895 therms/unit * Total Number of Units Built = Total therms in 2010

6,431 kWh/unit * Total Number of Units Built = Total kWh in 2010

Reference Analysis Files

The spreadsheets used to conduct the analysis for both the OR code savings and EnergyStar savings are attached to this memo transmittal. The "Tables" sheet in the file contains the summary data used to produce the tables in this memo.

2010 Code Savings:

WA_ID_MT_code_comparison.xls

Housing Census Data:

WA_Monthly_Data.xls

ID_Monthly_Data.xls

MT_Monthly_Data.xls

Appendix: Detailed Tables and Discussion of Results

The following Appendices give detailed tables of codes savings and system type distributions amongst climate zones for each state based upon 2010 housing starts. Not all climate zone combinations are present in every state. Of the nine possible combinations of heating and cooling climate zones, each state analyzed had counties assigned to six. In several cases, there were no estimated 2010 housing units built in a given climate zone combination. These fields are left blank in the tables below. In addition, electrically heated zonal and heat pump houses use no gas so the therm usage for these fields in the table are also left blank.

In Tables A3 and B3 which follow, it is noted that code changes between IECC 2003 and 2006 in Idaho, and between WSEC 2006 and 2003 in Washington have resulted a slight electricity loss rather than savings for some houses employing gas furnaces with air conditioning. Although the simulations predict an overall decrease in combined energy (gas and electricity site consumption) for every prototype, the interaction of the cooling system with the changes in insulation requirements have resulted in moderately increased electricity use. For example, buildings with little insulation between the house and ground benefit from cooler earth in the summer and require less cooling. Therefore, increasing the insulation in the floor, slabs, and basements of houses can have the effect of increasing the cooling load. Heating dominates the energy use of the houses in our simulations, however, and that use is always reduced by increasing insulation levels. Further, in these code cycles, the only changes effecting electricity use in gas furnace houses were items which reduced cooling use and heating system (furnace fan) run time. There are no other changes influencing electricity use which is why we see the slight negative numbers for some houses. In contrast, houses with electric heating: heat pumps and zonal resistance, the insulation effects on heating load are large and show significant electric savings. Lastly, these effects are present in all of the code models (ID, WA, and MT) and all climate zones but are only apparent in certain situations when individual end uses are examined separately.

In Summary:

Appendix Tables A1 through A7 outline Idaho Code Savings in 2010.

Appendix Tables B1 through B7 outline Washington Code Savings in 2010.

Appendix Tables C1 through C7 outline Montana Code savings in 2010.

The tables are arranged as follows in each section:

Table 1: Total Electric Energy Use

Total energy use by each system type in each climate zone for the state under the then extant code and the preceding code.

Table 2: Per Unit Electric Energy Use

Per unit energy use by each system type in each climate zone for the state under the then extant code and the preceding code.

Table 3: Total and per Unit Electric Energy Savings

Total energy savings from code change for each system type in each climate, followed by per housing unit savings for each system type in each climate.

Table 4: Total Gas Energy Use

Total energy use by each system type in each climate zone for the state under the then extant code and the preceding code.

Table 5: Per Unit Gas Energy Use

Per unit energy use by each system type in each climate zone for the state under the then extant code and the preceding code.

Table 6: Total and per Unit Gas Energy Savings

Total energy savings from code change for each system type in each climate, followed by per housing unit savings for each system type in each climate.

Table 7: Total Housing Units per state

The distribution and counts of estimated housing units built as each system type in each climate zone in 2010.

Table A1. 2010 Idaho New Construction Site Energy Use by System Type and Climate: Electric Energy Totals

| Electric Site Energy 2010 | | Idaho IECC 2006 | | | | | | Total Units per System Type |
|---------------------------|-------------|-----------------|---------------|---------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone1 | Heating Zone2 | | | Heating Zone3 | | |
| | | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | |
| Single Family KWh | Gas | 296,231 | 21,139 | 261,852 | 34,557 | 80,499 | 46,415 | 263 |
| | Gas with AC | 5,575,656 | 290,145 | 4,057,248 | 623,863 | 1,083,941 | 701,845 | 3,214 |
| | Heat pump | 1,725,742 | 140,827 | 1,785,405 | 243,434 | 618,665 | 363,517 | 283 |
| | Zonal | 1,795,019 | 151,096 | 1,871,650 | 247,001 | 632,342 | 364,607 | 283 |
| Multi Family KWh | Gas | 8,513 | 34,798 | 14,499 | | 19,040 | | 51 |
| | Gas with AC | 28,033 | 72,039 | 35,860 | | 37,873 | | 84 |
| | Heat pump | 25,824 | 116,886 | 50,171 | | 73,036 | | 21 |
| | Zonal | 305,561 | 1,482,048 | 617,520 | | 885,742 | | 265 |

| Electric Site Energy 2010 | | Idaho IECC 2003 | | | | | | Total Units per System Type |
|---------------------------|-------------|-----------------|---------------|---------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone1 | Heating Zone2 | | | Heating Zone3 | | |
| | | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | |
| Single Family KWh | Gas | 297,826 | 21,276 | 263,543 | 34,780 | 81,082 | 46,752 | 263 |
| | Gas with AC | 5,570,440 | 290,250 | 4,055,488 | 623,759 | 1,085,243 | 702,088 | 3,214 |
| | Heat pump | 1,743,472 | 142,529 | 1,806,219 | 246,192 | 626,541 | 368,014 | 283 |
| | Zonal | 1,833,194 | 154,405 | 1,912,632 | 252,410 | 646,598 | 372,827 | 283 |
| Multi Family KWh | Gas | 8,555 | 34,995 | 14,581 | | 19,158 | | 51 |
| | Gas with AC | 27,943 | 71,817 | 35,747 | | 37,784 | | 84 |
| | Heat pump | 25,985 | 117,725 | 50,515 | | 73,562 | | 21 |
| | Zonal | 310,470 | 1,506,270 | 627,613 | | 900,556 | | 265 |

Table A2. 2010 Idaho New Construction Site Energy Use by System Type and Climate: Electric Energy per Unit

| Electric Unit Energy 2010 | | Idaho IECC 2006 | | | | | |
|--|-------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | | Heating Zone1 | Heating Zone2 | | | Heating Zone3 | |
| | | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 |
| Single Family per Unit KWh | Gas | 2,650 | 2,890 | 2,890 | 2,890 | 3,088 | 3,088 |
| | Gas with AC | 4,078 | 3,243 | 3,661 | 4,266 | 3,399 | 3,817 |
| | Heat pump | 14,336 | 17,877 | 18,297 | 18,904 | 22,035 | 22,454 |
| | Zonal | 14,912 | 19,181 | 19,181 | 19,181 | 22,522 | 22,522 |
| Multi Family per Unit KWh | Gas | 1,339 | 1,510 | 1,510 | | 1,653 | |
| | Gas with AC | 2,645 | 1,876 | 2,241 | | 1,973 | |
| | Heat pump | 9,745 | 12,176 | 12,543 | | 15,216 | |
| | Zonal | 9,151 | 12,252 | 12,252 | | 14,645 | |

| Electric Unit Energy 2010 | | Idaho IECC 2003 | | | | | |
|--|-------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | | Heating Zone1 | Heating Zone2 | | | Heating Zone3 | |
| | | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 |
| Single Family per Unit KWh | Gas | 2,664 | 2,909 | 2,909 | 2,909 | 3,110 | 3,110 |
| | Gas with AC | 4,075 | 3,244 | 3,659 | 4,265 | 3,403 | 3,819 |
| | Heat pump | 14,484 | 18,093 | 18,510 | 19,118 | 22,315 | 22,732 |
| | Zonal | 15,229 | 19,601 | 19,601 | 19,601 | 23,030 | 23,030 |
| Multi Family per Unit KWh | Gas | 1,345 | 1,519 | 1,519 | | 1,663 | |
| | Gas with AC | 2,636 | 1,870 | 2,234 | | 1,968 | |
| | Heat pump | 9,806 | 12,263 | 12,629 | | 15,325 | |
| | Zonal | 9,298 | 12,453 | 12,453 | | 14,890 | |

Table A3. 2010 Idaho New Construction Site Energy Savings by System Type and Climate: Electric Energy

| Electric Total Energy Savings 2010 | | Idaho Total Savings | | | | | | Total Units per System Type |
|------------------------------------|-------------|---------------------|---------------|---------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone1 | Heating Zone2 | | | Heating Zone3 | | |
| | | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | |
| Single Family KWh | Gas | 1,594 | 137 | 1,691 | 223 | 583 | 336 | 263 |
| | Gas with AC | -5,216 | 105 | -1,760 | -105 | 1,302 | 243 | 3,214 |
| | Heat pump | 17,730 | 1,702 | 20,814 | 2,758 | 7,876 | 4,497 | 283 |
| | Zonal | 38,176 | 3,308 | 40,982 | 5,408 | 14,256 | 8,220 | 283 |
| Multi Family KWh | Gas | 42 | 197 | 82 | | 118 | | 51 |
| | Gas with AC | -91 | -222 | -113 | | -89 | | 84 |
| | Heat pump | 161 | 839 | 345 | | 525 | | 21 |
| | Zonal | 4,910 | 24,222 | 10,092 | | 14,815 | | 265 |

| Electric Unit Energy Savings 2010 | | Idaho per Unit Savings | | | | | |
|-----------------------------------|-------------|------------------------|---------------|---------------|---------------|---------------|---------------|
| | | Heating Zone1 | Heating Zone2 | | | Heating Zone3 | |
| | | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 |
| Single Family per Unit KWh | Gas | 14 | 19 | 19 | 19 | 22 | 22 |
| | Gas with AC | -4 | 1 | -2 | -1 | 4 | 1 |
| | Heat pump | 147 | 216 | 213 | 214 | 281 | 278 |
| | Zonal | 317 | 420 | 420 | 420 | 508 | 508 |
| Multi Family per Unit KWh | Gas | 7 | 9 | 9 | | 10 | |
| | Gas with AC | -9 | -6 | -7 | | -5 | |
| | Heat pump | 61 | 87 | 86 | | 109 | |
| | Zonal | 147 | 200 | 200 | | 245 | |

Table A4. 2010 Idaho New Construction Site Energy Use by System Type and Climate: Gas Energy Totals

| Gas Site Energy 2010 | | Idaho IECC 2006 | | | | | | Total Units per System Type |
|----------------------|-------------|-----------------|---------------|---------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone1 | Heating Zone2 | | | Heating Zone3 | | |
| | | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | |
| Single Family therms | Gas | 86,297 | 7,354 | 91,096 | 12,022 | 31,300 | 18,047 | 263 |
| | Gas with AC | 1,060,349 | 90,264 | 1,118,111 | 147,557 | 383,840 | 221,322 | 3,214 |
| | Heat pump | | | | | | | 283 |
| | Zonal | | | | | | | 283 |
| Multi Family therms | Gas | 3,196 | 15,495 | 6,456 | | 9,372 | | 51 |
| | Gas with AC | 5,355 | 25,933 | 10,805 | | 15,654 | | 84 |
| | Heat pump | | | | | | | 21 |
| | Zonal | | | | | | | 265 |

| Gas Site Energy 2010 | | Idaho IECC 2003 | | | | | | Total Units per System Type |
|----------------------|-------------|-----------------|---------------|---------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone1 | Heating Zone2 | | | Heating Zone3 | | |
| | | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | |
| Single Family therms | Gas | 7,502 | 92,928 | 12,264 | 31,921 | 18,405 | 7,502 | 263 |
| | Gas with AC | 92,085 | 1,140,666 | 150,533 | 391,533 | 225,757 | 92,085 | 3,214 |
| | Heat pump | | | | | | | 283 |
| | Zonal | | | | | | | 283 |
| Multi Family therms | Gas | 15,708 | 6,545 | | 9,498 | 15,708 | | 51 |
| | Gas with AC | 26,294 | 10,956 | | 15,867 | 26,294 | | 84 |
| | Heat pump | | | | | | | 21 |
| | Zonal | | | | | | | 265 |

Table A5. 2010 Idaho New Construction Site Energy Use by System Type and Climate: Gas Energy per Unit

| Gas Unit Energy 2010 | | Idaho IECC 2006 | | | | | |
|-------------------------------|-------------|-----------------|---------------|---------------|---------------|---------------|---------------|
| | | Heating Zone1 | Heating Zone2 | | | Heating Zone3 | |
| | | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 |
| Single Family per Unit therms | Gas | 772 | 1,005 | 1,005 | 1,005 | 1,201 | 1,201 |
| | Gas with AC | 776 | 1,009 | 1,009 | 1,009 | 1,204 | 1,204 |
| | Heat pump | | | | | | |
| | Zonal | | | | | | |
| Multi Family per Unit therms | Gas | 502 | 673 | 673 | | 814 | |
| | Gas with AC | 505 | 675 | 675 | | 815 | |
| | Heat pump | | | | | | |
| | Zonal | | | | | | |

| Gas Unit Energy 2010 | | Idaho IECC 2003 | | | | | |
|-------------------------------|-------------|-----------------|---------------|---------------|---------------|---------------|---------------|
| | | Heating Zone1 | Heating Zone2 | | | Heating Zone3 | |
| | | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 |
| Single Family per Unit therms | Gas | 788 | 1,026 | 1,026 | 1,026 | 1,224 | 1,224 |
| | Gas with AC | 792 | 1,029 | 1,029 | 1,029 | 1,228 | 1,228 |
| | Heat pump | | | | | | |
| | Zonal | | | | | | |
| Multi Family per Unit therms | Gas | 510 | 682 | 682 | | 824 | |
| | Gas with AC | 513 | 685 | 685 | | 826 | |
| | Heat pump | | | | | | |
| | Zonal | | | | | | |

Table A6. 2010 Idaho New Construction Site Energy Average Savings by System Type and Climate: Gas Energy

| Gas Total Energy Savings 2010 | | Idaho Total Savings | | | | | | Total Units per System Type |
|-------------------------------|-------------|---------------------|---------------|---------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone1 | Heating Zone2 | | | Heating Zone3 | | |
| | | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | |
| Single Family therms | Gas | 1,814 | 148 | 1,832 | 242 | 621 | 358 | 263 |
| | Gas with AC | 22,359 | 1,821 | 22,555 | 2,977 | 7,692 | 4,435 | 3,214 |
| | Heat pump | | | | | | | 283 |
| | Zonal | | | | | | | 283 |
| Multi Family therms | Gas | 47 | 213 | 89 | | 125 | | 51 |
| | Gas with AC | 80 | 361 | 150 | | 213 | | 84 |
| | Heat pump | | | | | | | 21 |
| | Zonal | | | | | | | 265 |

| Electric Unit Energy Savings 2010 | | Idaho per Unit Savings | | | | | |
|-----------------------------------|-------------|------------------------|---------------|---------------|---------------|---------------|---------------|
| | | Heating Zone1 | Heating Zone2 | | | Heating Zone3 | |
| | | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 |
| Single Family per Unit therms | Gas | 16 | 20 | 20 | 20 | 24 | 24 |
| | Gas with AC | 16 | 20 | 20 | 20 | 24 | 24 |
| | Heat pump | | | | | | |
| | Zonal | | | | | | |
| Multi Family per Unit therms | Gas | 7 | 9 | 9 | | 11 | |
| | Gas with AC | 8 | 9 | 9 | | 11 | |
| | Heat pump | | | | | | |
| | Zonal | | | | | | |

Table A7. 2010 Idaho New Construction Housing Distribution by System Type and Climate

| Distribution of Housing Units by Climate* | | Idaho 2010 Housing Units | | | | | | Total Units per System Type |
|---|-------------|--------------------------|---------------|---------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone1 | Heating Zone2 | | | Heating Zone3 | | |
| | | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | |
| Single Family | Gas | 112 | 7 | 91 | 12 | 26 | 15 | 263 |
| | Gas with AC | 1367 | 89 | 1108 | 146 | 319 | 184 | 3,214 |
| | Heat pump | 120 | 8 | 98 | 13 | 28 | 16 | 283 |
| | Zonal | 120 | 8 | 98 | 13 | 28 | 16 | 283 |
| Multi Family | Gas | 6 | 23 | 10 | 0 | 12 | 0 | 51 |
| | Gas with AC | 11 | 38 | 16 | 0 | 19 | 0 | 84 |
| | Heat pump | 3 | 10 | 4 | 0 | 5 | 0 | 21 |
| | Zonal | 33 | 121 | 50 | 0 | 60 | 0 | 265 |

* See Table 3 for the grand totals by house type and state.

The preceding set of seven tables gives the predicted site energy use and savings by system type and climate within Idaho.

Table B1. 2010 Washington New Construction Site Energy Use by System Type and Climate: Electric Energy Totals

| Electric Site Energy 2010 | | WSEC 2006 | | | | | | Total Units per System Type |
|------------------------------|-------------|------------------|------------------|------------------|------------------|------------------|------------------|--------------------------------------|
| | | Heating Zone1 | | | Heating Zone2 | | Heating Zone3 | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | |
| Single Family KWh | Gas | 22,839,322 | 1,013,240 | 3,615,754 | 609,055 | 3,591,855 | 52,707 | 8,889 |
| | Gas with AC | 13,304,362 | 649,000 | 2,617,545 | 348,896 | 2,255,983 | 29,817 | 4,643 |
| | Heat pump | 20,846,208 | 951,610 | 3,533,201 | 691,172 | 4,166,586 | 69,908 | 2,107 |
| | Zonal | 6,785,262 | 301,020 | 1,074,193 | 221,256 | 1,304,842 | 21,608 | 658 |
| Multi Family KWh | Gas | 1,006,425 | 16,663 | 1,282 | | 251,506 | | 591 |
| | Gas with AC | 2,038,467 | 38,131 | 3,412 | | 558,380 | | 985 |
| | Heat pump | 1,759,464 | 30,232 | 2,446 | | 563,194 | | 246 |
| | Zonal | 20,232,424 | 334,974 | 25,767 | | 6,380,554 | | 3,102 |

| Electric Site Energy 2010 | | WSEC 2003 | | | | | | Total Units per System Type |
|------------------------------|-------------|------------------|------------------|------------------|------------------|------------------|------------------|--------------------------------------|
| | | Heating Zone1 | | | Heating Zone2 | | Heating Zone3 | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | |
| Single Family KWh | Gas | 22,991,839 | 1,020,006 | 3,639,899 | 614,488 | 3,623,901 | 53,262 | 8,889 |
| | Gas with AC | 13,338,266 | 651,163 | 2,630,385 | 350,311 | 2,266,552 | 29,974 | 4,643 |
| | Heat pump | 21,422,759 | 977,486 | 3,627,859 | 714,408 | 4,304,629 | 72,497 | 2,107 |
| | Zonal | 7,076,285 | 313,931 | 1,120,266 | 231,156 | 1,363,225 | 22,596 | 658 |
| Multi Family KWh | Gas | 1,018,838 | 16,868 | 1,298 | | 255,681 | | 591 |
| | Gas with AC | 2,028,487 | 38,054 | 3,417 | | 558,480 | | 985 |
| | Heat pump | 1,836,270 | 31,525 | 2,548 | | 592,745 | | 246 |
| | Zonal | 21,788,931 | 360,744 | 27,750 | | 6,889,214 | | 3,102 |

Table B2. 2010 Washington New Construction Site Energy Use by System Type and Climate: Electric Energy per Unit

| Electric Unit Energy 2010 | | WSEC 2006 | | | | | |
|--|-------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | | Heating Zone1 | | | Heating Zone2 | | Heating Zone3 |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 |
| Single Family per Unit KWh | Gas | 3,546 | 3,546 | 3,546 | 3,723 | 3,723 | 3,869 |
| | Gas with AC | 3,954 | 4,348 | 4,914 | 4,083 | 4,477 | 4,190 |
| | Heat pump | 13,654 | 14,050 | 14,618 | 17,826 | 18,222 | 21,652 |
| | Zonal | 14,220 | 14,220 | 14,220 | 18,258 | 18,258 | 21,413 |
| Multi Family per Unit KWh | Gas | 2,136 | 2,136 | 2,136 | | 2,258 | |
| | Gas with AC | 2,596 | 2,933 | 3,412 | | 3,009 | |
| | Heat pump | 8,963 | 9,302 | 9,783 | | 12,138 | |
| | Zonal | 8,180 | 8,180 | 8,180 | | 10,914 | |

| Electric Unit Energy 2010 | | WSEC 2003 | | | | | |
|--|-------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | | Heating Zone1 | | | Heating Zone2 | | Heating Zone3 |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 |
| Single Family per Unit KWh | Gas | 3,569 | 3,569 | 3,569 | 3,756 | 3,756 | 3,910 |
| | Gas with AC | 3,964 | 4,362 | 4,938 | 4,100 | 4,498 | 4,212 |
| | Heat pump | 14,032 | 14,432 | 15,010 | 18,425 | 18,825 | 22,454 |
| | Zonal | 14,830 | 14,830 | 14,830 | 19,075 | 19,075 | 22,393 |
| Multi Family per Unit KWh | Gas | 2,163 | 2,163 | 2,163 | | 2,296 | |
| | Gas with AC | 2,583 | 2,927 | 3,417 | | 3,009 | |
| | Heat pump | 9,354 | 9,700 | 10,192 | | 12,775 | |
| | Zonal | 8,809 | 8,809 | 8,809 | | 11,784 | |

Table B3. 2010 Washington New Construction Site Energy Average Savings by System Type and Climate: Electric Energy

| Electric Total Energy Savings 2010 | | Washington Total Savings | | | | | |
|------------------------------------|-------------|--------------------------|---------------|---------------|---------------|---------------|---------------|
| | | Heating Zone1 | | | Heating Zone2 | | Heating Zone3 |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 |
| Single Family KWh | Gas | 152,516 | 6,766 | 24,145 | 5,434 | 32,046 | 555 |
| | Gas with AC | 33,904 | 2,163 | 12,840 | 1,415 | 10,569 | 157 |
| | Heat pump | 576,550 | 25,876 | 94,658 | 23,237 | 138,043 | 2,589 |
| | Zonal | 291,023 | 12,911 | 46,073 | 9,900 | 58,383 | 988 |
| Multi Family KWh | Gas | 12,412 | 206 | 16 | | 4,175 | |
| | Gas with AC | -9,980 | -77 | 5 | | 100 | |
| | Heat pump | 76,807 | 1,294 | 102 | | 29,551 | |
| | Zonal | 1,556,506 | 25,770 | 1,982 | | 508,659 | |

| Electric Unit Energy Savings 2010 | | Washington per Unit Savings | | | | | |
|-----------------------------------|-------------|-----------------------------|---------------|---------------|---------------|---------------|---------------|
| | | Heating Zone1 | | | Heating Zone2 | | Heating Zone3 |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 |
| Single Family per Unit KWh | Gas | 24 | 24 | 24 | 33 | 33 | 41 |
| | Gas with AC | 10 | 14 | 24 | 17 | 21 | 22 |
| | Heat pump | 378 | 382 | 392 | 599 | 604 | 802 |
| | Zonal | 610 | 610 | 610 | 817 | 817 | 980 |
| Multi Family per Unit KWh | Gas | 26 | 26 | 26 | | 37 | |
| | Gas with AC | -13 | -6 | 5 | | 1 | |
| | Heat pump | 391 | 398 | 409 | | 637 | |
| | Zonal | 629 | 629 | 629 | | 870 | |

Table B4. 2010 Washington New Construction Site Energy Use by System Type and Climate: Gas Energy Totals

| Gas Site Energy 2010 | | WSEC 2006 | | | | | | Total Units per System Type |
|----------------------|-------------|---------------|---------------|---------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone1 | | | Heating Zone2 | | Heating Zone3 | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | |
| Single Family therms | Gas | 4,707,701 | 208,852 | 745,289 | 155,636 | 917,851 | 15,471 | 8,889 |
| | Gas with AC | 2,469,956 | 109,577 | 391,025 | 81,585 | 481,140 | 8,101 | 4,643 |
| | Heat pump | | | | | | | 2,107 |
| | Zonal | | | | | | | 658 |
| Multi Family therms | Gas | 208,860 | 3,458 | 266 | | 66,089 | | 591 |
| | Gas with AC | 350,220 | 5,798 | 446 | | 110,673 | | 985 |
| | Heat pump | | | | | | | 246 |
| | Zonal | | | | | | | 3,102 |

| Gas Site Energy 2010 | | WSEC 2003 | | | | | | Total Units per System Type |
|----------------------|-------------|---------------|---------------|---------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone1 | | | Heating Zone2 | | Heating Zone3 | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | |
| Single Family therms | Gas | 4,938,139 | 219,075 | 781,770 | 163,349 | 963,336 | 16,241 | 8,889 |
| | Gas with AC | 2,591,688 | 114,977 | 410,297 | 85,639 | 505,049 | 8,508 | 4,643 |
| | Heat pump | | | | | | | 2,107 |
| | Zonal | | | | | | | 658 |
| Multi Family therms | Gas | 226,801 | 3,755 | 289 | | 71,768 | | 591 |
| | Gas with AC | 380,167 | 6,294 | 484 | | 120,156 | | 985 |
| | Heat pump | | | | | | | 246 |
| | Zonal | | | | | | | 3,102 |

Table B5. 2010 Washington New Construction Site Energy Use by System Type and Climate: Gas Energy per Unit

| Gas Unit Energy 2010 | | WSEC 2006 | | | | | |
|-------------------------------|-------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | | Heating Zone1 | | | Heating Zone2 | | Heating Zone3 |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 |
| Single Family per Unit therms | Gas | 731 | 731 | 731 | 951 | 951 | 731 |
| | Gas with AC | 734 | 734 | 734 | 955 | 955 | 734 |
| | Heat pump | | | | | | |
| | Zonal | | | | | | |
| Multi Family per Unit therms | Gas | 443 | 443 | 443 | | 593 | |
| | Gas with AC | 446 | 446 | 446 | | 596 | |
| | Heat pump | | | | | | |
| | Zonal | | | | | | |

| Gas Unit Energy 2010 | | WSEC 2003 | | | | | |
|-------------------------------|-------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | | Heating Zone1 | | | Heating Zone2 | | Heating Zone3 |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 |
| Single Family per Unit therms | Gas | 767 | 767 | 767 | 998 | 998 | 1,192 |
| | Gas with AC | 770 | 770 | 770 | 1,002 | 1,002 | 1,196 |
| | Heat pump | | | | | | |
| | Zonal | | | | | | |
| Multi Family per Unit therms | Gas | 481 | 481 | 481 | | 644 | |
| | Gas with AC | 484 | 484 | 484 | | 647 | |
| | Heat pump | | | | | | |
| | Zonal | | | | | | |

Table B6. 2010 Washington New Construction Site Energy Average Savings by System Type and Climate: Gas Energy

| Gas Site Energy Savings 2010 | | Washington Total Savings | | | | | | Total Units per System Type |
|------------------------------|-------------|--------------------------|---------------|---------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone1 | | | Heating Zone2 | | Heating Zone3 | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | |
| Single Family therms | Gas | 230,438 | 10,223 | 36,481 | 7,713 | 45,485 | 770 | 8,889 |
| | Gas with AC | 121,732 | 5,400 | 19,272 | 4,054 | 23,909 | 406 | 4,643 |
| | Heat pump | | | | | | | 2,107 |
| | Zonal | | | | | | | 658 |
| Multi Family therms | Gas | 17,941 | 297 | 23 | | 5,679 | | 591 |
| | Gas with AC | 29,948 | 496 | 38 | | 9,483 | | 985 |
| | Heat pump | | | | | | | 246 |
| | Zonal | | | | | | | 3,102 |

| Gas Unit Energy Savings 2010 | | Washington per Unit Savings | | | | | |
|-------------------------------|-------------|-----------------------------|---------------|---------------|---------------|---------------|---------------|
| | | Heating Zone1 | | | Heating Zone2 | | Heating Zone3 |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 |
| Single Family per Unit therms | Gas | 36 | 36 | 36 | 47 | 47 | 57 |
| | Gas with AC | 36 | 36 | 36 | 47 | 47 | 57 |
| | Heat pump | | | | | | |
| | Zonal | | | | | | |
| Multi Family per Unit therms | Gas | 38 | 38 | 38 | | 51 | |
| | Gas with AC | 38 | 38 | 38 | | 51 | |
| | Heat pump | | | | | | |
| | Zonal | | | | | | |

Table B7. 2010 Washington New Construction Housing Distribution by System Type and Climate

| Distribution of Housing Units by Climate* | | Washington 2010 Housing | | | | | | Total Units per System Type |
|---|-------------|-------------------------|---------------|---------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone1 | | | Heating Zone2 | | Heating Zone3 | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone3 | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | |
| Single Family | Gas | 6442 | 286 | 1020 | 164 | 965 | 14 | 8,889 |
| | Gas with AC | 3365 | 149 | 533 | 85 | 504 | 7 | 4,643 |
| | Heat pump | 1527 | 68 | 242 | 39 | 229 | 3 | 2,107 |
| | Zonal | 477 | 21 | 76 | 12 | 71 | 1 | 658 |
| Multi Family | Gas | 471 | 8 | 1 | 0 | 111 | 0 | 591 |
| | Gas with AC | 785 | 13 | 1 | 0 | 186 | 0 | 985 |
| | Heat pump | 196 | 3 | 0 | 0 | 46 | 0 | 246 |
| | Zonal | 2473 | 41 | 3 | 0 | 585 | 0 | 3,102 |

* See Table 3 for the grand totals by house type and state.

The preceding set of seven tables gives the predicted site energy use and savings by system type and climate within Washington.

Table C1. 2010 Montana New Construction Site Energy Use by System Type and Climate: Electric Energy Totals

| Electric Site Energy 2010 | | Montana IECC 2003 | | | | Total Units per System Type |
|------------------------------|-------------|-------------------|------------------|------------------|------------------|--------------------------------------|
| | | Heating Zone3 | | Heating Zone2 | | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | Cooling Zone2 | |
| Single Family KWh | Gas | 935,027 | 183,509 | 65,769 | 10,228 | 391 |
| | Gas with AC | 1,773,620 | 390,614 | 127,133 | 22,301 | 661 |
| | Heat pump | 1,461,540 | 292,339 | 89,187 | 14,197 | 87 |
| | Zonal | 1,501,035 | 294,593 | 95,986 | 14,927 | 87 |
| Multi Family KWh | Gas | 37,524 | 750 | | | 24 |
| | Gas with AC | 74,184 | 1,763 | | | 40 |
| | Heat pump | 140,226 | 2,875 | | | 10 |
| | Zonal | 1,686,046 | 33,721 | | | 126 |

| Electric Site Energy 2010 | | MEC 1996 | | | | Total Units per System Type |
|------------------------------|-------------|------------------|------------------|------------------|------------------|--------------------------------------|
| | | Heating Zone3 | | Heating Zone2 | | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | Cooling Zone2 | |
| Single Family KWh | Gas | 958,589 | 188,133 | 67,166 | 10,445 | 391 |
| | Gas with AC | 1,855,381 | 411,249 | 132,738 | 23,445 | 661 |
| | Heat pump | 1,557,031 | 311,671 | 94,514 | 15,060 | 87 |
| | Zonal | 1,599,864 | 313,990 | 101,964 | 15,857 | 87 |
| Multi Family KWh | Gas | 40,713 | 814 | | | 24 |
| | Gas with AC | 77,965 | 1,865 | | | 40 |
| | Heat pump | 150,130 | 3,080 | | | 10 |
| | Zonal | 1,990,514 | 39,810 | | | 126 |

Table C2. 2010 Montana New Construction Site Energy Use by System Type and Climate: Electric Energy per Unit

| Electric Unit Energy 2010 | | Montana IECC 2003 | | | |
|--|-------------|-------------------|------------------|------------------|------------------|
| | | Heating Zone3 | | Heating Zone2 | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | Cooling Zone2 |
| Single Family per Unit KWh | Gas | 3,066 | 3,066 | 2,873 | 2,873 |
| | Gas with AC | 3,378 | 3,791 | 4,704 | 3,638 |
| | Heat pump | 21,635 | 22,050 | 17,585 | 17,999 |
| | Zonal | 22,220 | 22,220 | 18,925 | 18,925 |
| Multi Family per Unit KWh | Gas | 1,595 | 1,595 | | |
| | Gas with AC | 1,892 | 2,248 | | |
| | Heat pump | 14,307 | 14,666 | | |
| | Zonal | 13,653 | 13,653 | | |

| Electric Unit Energy 2010 | | MEC 1996 | | | |
|--|-------------|------------------|------------------|------------------|------------------|
| | | Heating Zone3 | | Heating Zone2 | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | Cooling Zone2 |
| Single Family per Unit KWh | Gas | 3,143 | 3,143 | 2,934 | 2,934 |
| | Gas with AC | 3,534 | 3,991 | 4,912 | 3,825 |
| | Heat pump | 23,049 | 23,508 | 18,635 | 19,094 |
| | Zonal | 23,683 | 23,683 | 20,104 | 20,104 |
| Multi Family per Unit KWh | Gas | 1,731 | 1,731 | | |
| | Gas with AC | 1,989 | 2,379 | | |
| | Heat pump | 15,318 | 15,711 | | |
| | Zonal | 16,118 | 16,118 | | |

Table C3. 2010 Montana New Construction Site Energy Savings by System Type and Climate: Electric Energy

| Electric Total Energy Savings 2010 | | Montana Total Savings | | | | Total Units per System Type |
|------------------------------------|-------------|-----------------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone3 | | Heating Zone2 | | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | Cooling Zone2 | |
| Single Family KWh | Gas | 23,562 | 4,624 | 1,397 | 217 | 391 |
| | Gas with AC | 81,761 | 20,635 | 5,605 | 1,145 | 661 |
| | Heat pump | 95,491 | 19,332 | 5,326 | 863 | 87 |
| | Zonal | 98,830 | 19,396 | 5,979 | 930 | 87 |
| Multi Family KWh | Gas | 3,188 | 64 | | | 24 |
| | Gas with AC | 3,781 | 103 | | | 40 |
| | Heat pump | 9,904 | 205 | | | 10 |
| | Zonal | 304,468 | 6,089 | | | 126 |

| Electric Unit Energy Savings 2010 | | Montana per Unit Savings | | | |
|-----------------------------------|-------------|--------------------------|---------------|---------------|---------------|
| | | Heating Zone3 | | Heating Zone2 | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | Cooling Zone2 |
| Single Family per Unit KWh | Gas | 77 | 77 | 61 | 61 |
| | Gas with AC | 156 | 200 | 207 | 187 |
| | Heat pump | 1,414 | 1,458 | 1,050 | 1,095 |
| | Zonal | 1,463 | 1,463 | 1,179 | 1,179 |
| Multi Family per Unit KWh | Gas | 136 | 136 | | |
| | Gas with AC | 96 | 131 | | |
| | Heat pump | 1,010 | 1,045 | | |
| | Zonal | 2,465 | 2,465 | | |

Table C4. 2010 Montana New Construction Site Energy Use by System Type and Climate: Gas Energy Totals

| Gas Site Energy 2010 | | Montana IECC 2003 | | | | Total Units per System Type |
|----------------------|-------------|-------------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone3 | | Heating Zone2 | | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | Cooling Zone2 | |
| Single Family therms | Gas | 359,098 | 70,477 | 22,587 | 3,513 | 391 |
| | Gas with AC | 619,792 | 121,641 | 39,019 | 6,068 | 661 |
| | Heat pump | | | | | 87 |
| | Zonal | | | | | 87 |
| Multi Family therms | Gas | 17,703 | 354 | | | 24 |
| | Gas with AC | 26,694 | 534 | | | 40 |
| | Heat pump | | | | | 10 |
| | Zonal | | | | | 126 |

| Gas Site Energy 2010 | | MEC 1996 | | | | Total Units per System Type |
|----------------------|-------------|---------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone3 | | Heating Zone2 | | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | Cooling Zone2 | |
| Single Family therms | Gas | 384,298 | 75,422 | 24,104 | 3,748 | 391 |
| | Gas with AC | 664,562 | 130,427 | 41,700 | 6,485 | 661 |
| | Heat pump | | | | | 87 |
| | Zonal | | | | | 87 |
| Multi Family therms | Gas | 21,085 | 422 | | | 24 |
| | Gas with AC | 29,206 | 584 | | | 40 |
| | Heat pump | | | | | 10 |
| | Zonal | | | | | 126 |

Table C5. 2010 Montana New Construction Site Energy Use by System Type and Climate: Gas Energy per Unit

| Gas Unit Energy 2010 | | Montana IECC 2003 | | | |
|-------------------------------|-------------|-------------------|---------------|---------------|---------------|
| | | Heating Zone3 | | Heating Zone2 | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | Cooling Zone2 |
| Single Family per Unit therms | Gas | 1,178 | 1,178 | 987 | 987 |
| | Gas with AC | 1,181 | 1,181 | 1,444 | 990 |
| | Heat pump | | | | |
| | Zonal | | | | |
| Multi Family per Unit therms | Gas | 753 | 753 | | |
| | Gas with AC | 681 | 681 | | |
| | Heat pump | | | | |
| | Zonal | | | | |

| Gas Unit Energy 2010 | | MEC 1996 | | | |
|-------------------------------|-------------|---------------|---------------|---------------|---------------|
| | | Heating Zone3 | | Heating Zone2 | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | Cooling Zone2 |
| Single Family per Unit therms | Gas | 1,260 | 1,260 | 1,053 | 1,053 |
| | Gas with AC | 1,266 | 1,266 | 1,543 | 1,058 |
| | Heat pump | | | | |
| | Zonal | | | | |
| Multi Family per Unit therms | Gas | 896 | 896 | | |
| | Gas with AC | 745 | 745 | | |
| | Heat pump | | | | |
| | Zonal | | | | |

Table C6. 2010 New Construction Site Energy Savings by System Type and Climate: Gas Energy

| Gas Total Energy Savings 2010 | | Montana Total Savings | | | | Total Units per System Type |
|-------------------------------|-------------|-----------------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone3 | | Heating Zone2 | | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | Cooling Zone2 | |
| Single Family therms | Gas | 25,200 | 4,946 | 1,517 | 236 | 391 |
| | Gas with AC | 44,770 | 8,787 | 2,681 | 417 | 661 |
| | Heat pump | | | | | 87 |
| | Zonal | | | | | 87 |
| Multi Family therms | Gas | 3,381 | 68 | | | 24 |
| | Gas with AC | 2,512 | 50 | | | 40 |
| | Heat pump | | | | | 10 |
| | Zonal | | | | | 126 |

| Gas Unit Energy Savings 2010 | | Montana per Unit Savings | | | |
|-------------------------------|-------------|--------------------------|---------------|---------------|---------------|
| | | Heating Zone3 | | Heating Zone2 | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | Cooling Zone2 |
| Single Family per Unit therms | Gas | 83 | 83 | 66 | 66 |
| | Gas with AC | 85 | 85 | 99 | 68 |
| | Heat pump | | | | |
| | Zonal | | | | |
| Multi Family per Unit therms | Gas | 144 | 144 | | |
| | Gas with AC | 64 | 64 | | |
| | Heat pump | | | | |
| | Zonal | | | | |

Table C7. 2010 New Construction Site Distribution by System Type and Climate: Montana State

| Distribution of Housing Units by Climate* | | Montana 2010 Housing | | | | Total Units per System Type |
|---|-------------|----------------------|---------------|---------------|---------------|-----------------------------|
| | | Heating Zone3 | | Heating Zone2 | | |
| | | Cooling Zone1 | Cooling Zone2 | Cooling Zone1 | Cooling Zone2 | |
| Single Family therms | Gas | 305 | 60 | 23 | 4 | 391 |
| | Gas with AC | 525 | 103 | 27 | 6 | 661 |
| | Heat pump | 68 | 13 | 5 | 1 | 87 |
| | Zonal | 68 | 13 | 5 | 1 | 87 |
| Multi Family therms | Gas | 24 | 0 | 0 | 0 | 24 |
| | Gas with AC | 39 | 1 | 0 | 0 | 40 |
| | Heat pump | 10 | 0 | 0 | 0 | 10 |
| | Zonal | 123 | 2 | 0 | 0 | 126 |

* See Table 3 for the grand totals by house type and state.

The preceding set of seven tables gives the predicted site energy use and savings by system type and climate within Montana.