



STATE OF WASHINGTON
DEPARTMENT OF COMMERCE

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September 27, 2019

Doug Orth, Chair
Council Members
Washington State Building Code Council

RE: Comments on the proposed changes to the WSEC Section 406, Part 1 of 2.

Mr. Orth and Council Members,

In support of the Council consideration of the proposed changes to the Washington State Energy Code, an analysis was conducted on the measures moved forward in the CR-102. Based on this analysis, we recommend several technical and editorial corrections to Tables R406.2 and R406.3 published in the proposed 2018 WSEC-Residential (CR-102). Overall, these recommended changes result in decreased first costs for the majority of home designs analyzed. This work was conducted by the energy consultants David Baylon and Poppy Storm with generous funding from the Northwest Energy Efficiency Alliance.

In a separate public comment, the Department of Commerce presented summaries of cost and savings estimates for a series of least first cost scenarios to comply with the proposed 2018 residential energy code. The summaries were developed to assess impacts of the final package of proposals as integrated into the CR-102 Proposed Rule Making released August 6, 2019. As part of this process, analysts identified a typographical error and some inconsistencies in the carbon emission credit values in the R406 equalization and option tables of the CR-102 document. The credit values were reconciled with the energy use and savings summaries from the complete and final analysis conducted by Ecotope for Proposal 19-WSEC-R23. The analysis led to increased credit values for one of the system types in the equalization table and four of the options in the options table. These credit value increases would effectively decrease the overall number of options and costs necessary to achieve the total credits required for most of the modeled prototypes. We recommend revising the credit values to align with the corrected values described below and detailed in the equalization and options tables included at the end of this testimony. These changes could result in a decrease in costs of approximately \$0.50 to \$3.00 per square foot for the majority of prototypes, with nearly half dropping to less than \$1.00. The recommended adjustments are listed below, and an edited table is provided on the subsequent pages.



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Recommended Changes

1. **Table R406.3:** The heat pump measure, Option 3.2, is assigned 0.5 credits in CR-102. Based on our assessment of the final MVE committee recommendation to the Council for inclusion in CR-102, Option 3.2 should have been 1 credit. This variance is likely due to a typographical error and we recommend correcting it from .5 to 1 credit.
2. **Table R406.3:** There are three heat pump water heater options in Table R406.3. An inconsistency in the domestic hot water (DHW) base case energy use caused the credits assigned to each of these options (5.4, 5.5, and 5.6) to be reduced by 0.5 points. We recommend correcting these credit values by adding 0.5 credits to each of these three heat pump water heater options.
3. **Table R406.2:** In the CR-102, System Type #4, zonal electric with DHP (as required in the 2015 WSEC), was assigned no equalization credits. The reconciled analysis shows that it should be assigned 0.5 credits. While this combination is relatively rare in Washington State, this correction results in a cost decrease for medium size homes using this heating system. We recommend correcting the equalization credit to 0.5 for System Type #4.

Recommended adjustments are also included as strike-through edits with yellow highlights in the CR-102 tables below.



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TABLE R406.2
FUEL NORMALIZATION CREDITS

<u>System Type</u>	<u>Description of Primary Heating Source</u>	<u>Credits</u>	
		<u>All Other</u>	<u>Group R-2</u>
<u>1</u>	<u>Combustion heating equipment meeting minimum federal efficiency standards for the equipment listed in Table C403.3.2(4) or C403.3.2(5)</u>	<u>0</u>	<u>0</u>
<u>2</u>	<u>For an initial heating system using a heat pump that meets federal standards for the equipment listed in Table C403.3.2(1)C or C403.3.2(2)</u> <u>or</u> <u>Air to water heat pump units that are configured to provide both heating and cooling and are rated in accordance with AHRI 550/590</u>	<u>1.0</u>	<u>1.0</u>
<u>3</u>	<u>For heating system based on electric resistance only (either forced air or Zonal)</u>	<u>-1.0</u>	<u>-1.0</u>
<u>4</u>	<u>For heating system based on electric resistance with a ductless mini-split heat pump system in accordance with Section R403.7.1 including the exception</u>	<u>0</u> <u>0.5</u>	<u>N/A</u>
<u>5</u>	<u>All other heating systems</u>	<u>-1</u>	<u>-0.5</u>



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TABLE ((406-2)) 406.3
ENERGY CREDITS

3. HIGH EFFICIENCY HVAC EQUIPMENT OPTIONS			
<u>Only one option from Items 3.1 through 3.6 may be selected in this category.</u>			
3.1 ^a	<u>Energy Star rated (U.S. North) Gas or propane furnace with minimum AFUE of 95%</u> or <u>Energy Star rated (U.S. North) Gas or propane boiler with minimum AFUE of 90%.</u> <u>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.</u>	<u>1.0</u>	<u>1.0</u>
3.2 ^a	<u>Air-source centrally ducted heat pump with minimum HSPF of 9.5.</u> <u>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.</u>	0.5 <u>1.0</u>	<u>N/A</u>
3.3 ^a	<u>Closed-loop ground source heat pump; with a minimum COP of 3.3</u> or <u>Open loop water source heat pump with a maximum pumping hydraulic head of 150 feet and minimum COP of 3.6.</u> <u>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.</u>	<u>1.5</u>	<u>1.0</u>
3.4	<u>Ductless mini-split heat pump system, zonal control: In homes where the primary space heating system is zonal electric heating, a ductless mini-split heat pump system with a minimum HSPF of 10.0 shall be installed and provide heating to the largest zone of the housing unit.</u> <u>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.</u>	<u>1.5</u>	<u>2.0</u>



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TABLE ((406-2)) 406.3
ENERGY CREDITS

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2
<u>5.3</u>	<p>Water heating system shall include one of the following: <u>Energy Star rated gas or propane water heater with a minimum UEF of 0.91</u> or <u>Solar water heating supplementing a minimum standard water heater. Solar water heating will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems</u> or <u>Water heater heated by ground source heat pump meeting the requirements of Option 3.3.</u> <u>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency and, for solar water heating systems, the calculation of the minimum energy savings.</u></p>	<u>1.0</u>	<u>1.0</u>
<u>5.4</u>	<p>Water heating system shall include one of the following: <u>Electric heat pump water heater meeting the standards for Tier I of NEEA's advanced water heating specification</u> or <u>For R-2 Occupancy, electric heat pump water heater(s), meeting the standards for Tier I of NEEA's advanced water heating specification, shall supply domestic hot water to all units. If one water heater is serving more than one dwelling unit, all hot water supply and recirculation piping shall be insulated with R-8 minimum pipe insulation.</u> <u>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.</u></p>	1.0 <u>1.5</u>	<u>2.0</u>
<u>5.5</u>	<p>Water heating system shall include one of the following: <u>Electric heat pump water heater meeting the standards for Tier III of NEEA's advanced water heating specification</u> or <u>For R-2 Occupancy, electric heat pump water heater(s), meeting the standards for Tier III of NEEA's advanced water heating specification, shall supply domestic hot water to all units. If one water heater is serving more than one dwelling unit, all hot water supply and recirculation piping shall be insulated with R-8 minimum pipe insulation.</u> <u>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.</u></p>	1.5 <u>2.0</u>	<u>2.5</u>



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TABLE ((406-2)) 406.3
ENERGY CREDITS

<u>OPTION</u>	<u>DESCRIPTION</u>	<u>CREDIT(S)</u>	
		<u>All Other</u>	<u>Group R-2</u>
5.6	<p>Water heating system shall include one of the following:</p> <p><u>Electric heat pump water heater with a minimum UEF of 2.9 and utilizing a split system configuration with the air-to-refrigerant heat exchanger located outdoors. Equipment shall meet Section 4, requirements for all units, of the NEEA standard <i>Advanced Water Heating Specification</i> with the UEF noted above</u></p> <p>or</p> <p><u>For R-2 Occupancy, electric heat pump water heater(s), meeting the standards for Tier III of NEEA's advanced water heating specification and utilizing a split system configuration with the air-to-refrigerant heat exchanger located outdoors, shall supply domestic hot water to all units. If one water heater is serving more than one dwelling unit, all hot water supply and recirculation piping shall be insulated with R-8 minimum pipe insulation.</u></p> <p><u>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.</u></p>	<u>2.9</u> <u>2.5</u>	<u>3.0</u>

Thank you for your consideration,

Chuck Murray
Sr. Energy Policy Specialist



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September 27, 2019

Doug Orth, Chair
Council Members
Washington State Building Code Council

RE: Comments on the proposed changes to the WSEC Section 406, Part 2 of 2.

Mr. Orth and Council Members,

In support of the Council consideration of the proposed changes to the Washington State Energy Code, an analysis was conducted on the measures moved forward in the CR-102. This work was conducted by the energy consultants David Baylon and Poppy Storm with generous funding from the Northwest Energy Efficiency Alliance.

Prior to review of this document, we recommend Council members consider recommendations for changes to the energy code credits submitted by Commerce as “part 1 of 2”. Adoption of this recommended action will result in lower first cost for many projects. We also recommend that Council members refer to the code change proposal 19-WSEC-R23 for more detailed cost documentation.

The proposed 2018 residential energy code is the result of nearly a year of analysis, technical review, iterations, and collaboration. It is structured to deliver cost and energy savings in accordance with the RCW 19.27A.160 requirement to reduce energy use by 70% by 2031. The purpose of this public comment is to summarize estimated costs and savings resulting from the full package of proposals as integrated into the CR-102 Proposed Rulemaking released August 6, 2019. The summaries in the tables below are based on the vetted costs and energy savings developed by Ecotope for the supporting documentation in Proposal 19-WSEC-R23.

Table 1 below summarizes a range of least cost scenarios for residential construction based on the R406 options table credits in the proposed 2018 residential energy code (CR-102). The table includes medium, small, and low-rise multifamily homes. Each scenario consists of a combination of dwelling size, space heating fuel, domestic hot water (DHW) heating fuel, and air conditioning (AC). The equipment selection for each scenario is based on a combination of the least-cost options necessary to achieve the number of credits required for that dwelling size. Estimates of incremental costs above the 2015 code, first year cost savings, and the net present value are summarized for each scenario. The incremental costs range from \$0.70 to \$3.50 per square foot, with most being less than \$2.00. In all cases, the 2018 scenarios are cost-effective under the approved life cycle cost analysis (LCCA) tool.

Table 2 presents revised costs estimates using the recommended credit adjustments. The affected scenarios are highlighted in pink. As shown in Table 2, if the credit adjustment recommendations are accepted, the costs will decrease substantially for most of the scenarios. For example, the incremental



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costs for half of the scenarios would drop to less than \$1.00. The other public comment recommends a correction to the credit values for several of the options based on analysis conducted to reconcile the carbon credit assignments with the energy use and savings summaries from the complete and final analysis conducted by Ecotope for Proposal 19-WSEC-R23. The reconciled analysis includes an increase in the number of credits for the three heat pump water heater options (5.4., 5.5, and 5.6) by half a point each and assigns half a point to System Type #4 (electric resistance with DHP) in the fuel normalization table (p 36, CR-102).

Table 1. Cost and Savings Estimates for the Proposed 2018 Residential Energy Code

Prototype	Scenario	Heating Fuel	DHW Fuel	Cooling	Incremental Cost 2015-2018	Energy Cost Savings	Lifecycle Cost Analysis*
					\$/SF	\$/YR	Net Present Value
2200 SF	1	Gas	Elect	AC	\$1.74	\$218	\$3,479
2200 SF	2	Gas	Gas	AC	\$3.06	\$191	\$1,731
1344 SF	1	Gas	Elect	No	\$1.48	\$156	\$2,567
1344 SF	2	Gas	Gas	No	\$1.66	\$159	\$2,567
2200 SF	1	HP	Elect	HP	\$1.15	\$259	\$6,941
1344 SF	1	HP	Elect	HP	\$2.12	\$203	\$1,936
2200 SF	1	Elect/DHP	Elect	DHP	\$3.49	\$361	\$5,812
1344 SF	1	Elect/DHP	Elect	DHP	\$1.76	\$334	\$7,154
MF 800 SF	1	Elect	Elect	No	\$0.70	\$125	\$3,607
*Washington State Life Cycle Cost Analysis							

Table 2. Revised Cost and Savings Estimates Using Adjusted Credit Values in the Proposed 2018 Residential Energy Code (Impact of changes in credit values shown in pink.)

Prototype	Scenario	Heating Fuel	DHW Fuel	Cooling	Incremental Cost 2015-2018	Energy Cost Savings	Lifecycle Cost Analysis*
					\$/SF	\$/YR	Net Present Value
2200 SF	1	Gas	Elect	AC	\$0.70	\$204	\$6,293
2200 SF	2	Gas	Gas	AC	\$3.06	\$191	\$1,731
1344 SF	1	Gas	Elect	No	\$1.26	\$113	\$906
1344 SF	2	Gas	Gas	No	\$1.66	\$159	\$2,567
2200 SF	1	HP	Elect	HP	\$0.43	\$77	\$4,247
1344 SF	1	HP	Elect	HP	\$1.61	\$120	\$825
2200 SF	1	Elect/DHP	Elect	DHP	\$0.58	\$172	\$6,645
1344 SF	1	Elect/DHP	Elect	DHP	\$0.84	\$176	\$6,770
MF 800 SF	1	Elect	Elect	No	\$0.70	\$125	\$3,607



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Analysis Overview

The analysis presented in this memo includes three prototypes: a 2200 square foot (sf) single family home, a 1344 sf single family home, and an 800-sf multifamily unit. This is a subset of the prototypes used for the overall code savings analysis in Proposal 19-WSEC-R23, but they represent a range of sizes that is typical of homes built to this code.

Each of these prototypes were run with a combination of mechanical equipment. The heating equipment specified in Tables 1 and 2 is used to set the equalization credits. In all cases the heating equipment fuel is fixed but the efficiency of the equipment varies using the options. The total credits required are based on the CR-102 document. In these scenarios, the CR-102 credit values of each option are used for Table 1 and adjusted CR-102 credit values are used for Table 2. The scenario costs are expressed as incremental costs over the options required in the 2015 code.

The Appendix lists the options used in each scenario. These options were selected as the least cost options needed to meet the credit totals required for each dwelling size. The alternative scenarios use the recommended adjustments to the option credits and equalization tables in the CR-102 Proposed Rulemaking.

The energy cost savings are the first-year savings to the home as a result of the options selected. These savings are incremental from the 2015 code. The costs are calculated based on utility costs of \$0.097/kWh and \$1.062/therm.

Thank you for your consideration,

A handwritten signature in black ink that reads "Chuck Murray".

Chuck Murray
Sr. Energy Policy Specialist