



STATE OF WASHINGTON  
**STATE BUILDING CODE COUNCIL**

Washington State Energy Code Development  
**Standard Energy Code Proposal Form**

May 2018

Log No. 19-WSEC-R36 Rev  
Proponent 5/16/19  
TAG Mods 5/17/19

Code being amended:  Commercial Provisions  Residential Provisions

Code Section # **R402.4.1.2, R403.3.7, R405.3, R406**

Brief Description: This proposal updates Section R406 based on carbon emissions drawn from the carbon accounting included in the final proposed commercial energy code approved by the SBCC in 2018 (Table C403.3(1)). This proposal and requires additional energy efficiency credits which have been renormalized using Carbon accounting in Table C403.3(1) to ~~account~~ give credit based on the impact on carbon emissions of each option. ~~for the carbon impact of improved efficiency in the various energy sources used by dwelling units.~~ It also amends portions of the prescriptive code, as required, to support proposed revisions to Section R406. Finally, it alters the performance path in Section 405.3 to include carbon emissions as the basis for performance compliance with the residential energy code. This section now includes the carbon emissions table transferred from the approved commercial energy code.

Proposed code change text: (Copy the existing text from the Integrated Draft, linked above, and then use underline for new text and ~~strikeout~~ for text to be deleted.)

**R402.4.1.2 Testing.** The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding 5 air changes per hour. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope. Once visual inspection has confirmed sealing (see Table R402.4.1.1), operable windows and doors manufactured by small business shall be permitted to be sealed off at the frame prior to the test.

**Exception.** For dwelling units that are accessed directly from the outdoors, other than detached one-family dwellings and townhouses, an air leakage rate not exceeding 0.4 cfm per ft<sup>2</sup> of the dwelling unit enclosure area shall be an ~~accepted~~ allowable alternative. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals) in accordance with RESNET/ICC 380, ASTM E779 or ASTM E1827. ~~When the test is conducted on the dwelling unit doors~~ Doors and windows of adjacent dwelling units (including top- and bottom units) shall be open to the outside during the test. ~~When-This exception is not permitted for dwelling units that are accessed from corridors or other located in a single building with enclosed common areas, including corridors, a whole building test is required.~~

Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779 or ASTM E1827.

**R403.3.7 Ducts located in conditioned space.** For ducts to be considered as being located inside a conditioned space, such ducts shall comply with either one of the following:

1. The duct system shall be located completely within the continuous air barrier and within the building thermal envelope.
2. All heating, cooling and ventilation system components shall be installed inside the conditioned space, including but not limited to. ~~This includes all equipment and distribution system components such as~~ forced air ducts, hydronic piping, hydronic floor heating loops, convectors and radiators. ~~All~~ Combustion equipment shall be direct vent or sealed combustion.

~~May 21, 2019~~ May 17, 2019

3. For forced air ducts: A maximum of 10 linear feet of return ducts and 5 linear feet of supply ducts may be permitted to be located outside the conditioned space. Ducts located outside the conditioned space must be provided they are insulated to a minimum of R-8.
4. All metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic.
5. If flex ducts are used, they cannot contain splices. Flex duct connections must be made with nylon straps and installed using a plastic strapping tensioning tool

**R405.3 Performance-based compliance.** Compliance based on simulated energy performance requires that a proposed residence (*proposed design*) be shown to have an annual site energy energy consumption based on site energy carbon emissions of the fuels and energy use in the proposed building. Carbon emissions for both the *standard reference design* and the *proposed design* shall be calculated using Table R405.3.1. Energy use derived from simulation analysis shall be expressed in Btu Btu-pounds of carbon and Btu Btu-pounds of carbon Btu per square foot of *conditioned floor area* as follows:

1. For structures less than 1,500 square feet of conditioned floor area, the annual energy consumption carbon emissions energy consumption shall be less than or equal to ~~80~~ 70 percent of the annual carbon emissions energy consumption energy consumption of the *standard reference design*.
2. For structures 1,500 to 5,000 square feet of conditioned floor area, the annual carbon emissions energy consumption energy consumption shall be no more than ~~72~~ 62 percent of the *standard reference design*.
3. For structures over 5,000 square feet of conditioned floor area, the annual carbon emissions energy consumption energy consumption shall be no more than ~~66~~ 56 percent of the *standard reference design*.
4. **Exception:** For structures serving Group R-2 occupancies, the annual carbon emissions energy consumption energy consumption shall be less than or equal to ~~85~~ 70 percent of the annual carbon emissions energy consumption energy consumption of the *standard reference design*.

**TABLE R405.3.1**  
**CARBON EMISSIONS**  
**FACTORS**

Type	CO2e (lb/unit)	Unit
Electricity	0.70	kWh
Natural Gas	11.7	Therm
Oil	19.2	Gallon
Propane	10.5	Gallon
Other <sup>a</sup>	195.00	mmBtu
On-site renewable energy	0.00	

<sup>a</sup>District energy systems may use alternative emission factors

- 4- supported by calculations approved by the *code official*.

## SECTION R406

### ADDITIONAL ENERGY EFFICIENCY REQUIREMENTS

**R406.1 Scope.** This section establishes options for additional criteria to be met for one- and two-family dwellings and townhouses, as defined in Section 101.2 of the *International Residential Code*, and dwelling units in *residential buildings*, to demonstrate compliance with this code. Credits from both sections R406.2 and R406.3 are required.

**R406.2 Carbon emission equalization.** This paragraph establishes a base equalization between fuels used to define the equivalent carbon emissions of the options specified. The permit shall define the base fuel selection to be used and the points specified in Table 406.1 shall be used to modify the requirements in Section 406.3. The sum of credits from Table 406.1 and table 406.2 shall meet the requirements of section R406.3

### Table 406.1 Fuel Emissions Credits.

Option	Description	Credits (Single Family)	Credits (Group R-2, R-3, R-4)
a	For heating system using Gas furnace with minimum efficiency in accords with federal standards (AFUE 80)	0	N/A
b	For heating system using a heat pump that meets federal standards	1.0	1.0
c	For heating system based on electric resistance only (either forced air or Zonal)	-1.0	-1.0
d	For heating system based on electric resistance with a DHP per section R403.XX (R403.7.1 including the exception (either forced air or Zonal)	0	N/A

**R406.23 Additional energy efficiency requirements (Mandatory).** Credits determined in Section R406.2 shall be included in the credits used to establish compliance with this section. Each dwelling unit in a residential building shall comply with sufficient options from Table R406.2 so as to achieve the following minimum number of credits:

1. Small Dwelling Unit: .....4.0 credits  
Dwelling units less than 1500 square feet in conditioned floor area with less than 300 square feet of fenestration area. Additions to existing building greater than 500 square feet of heated floor area but less than 1500 square feet.
2. Medium Dwelling Unit: ..... 5.0 credits  
All dwelling units that are not included in #1 or #3.
3. Large Dwelling Unit: ..... 6.0 credits  
Dwelling units exceeding 5000 square feet of conditioned floor area.
4. Dwelling units serving R-2 occupancies:... 4.5 credits
5. Additions less than 500 square feet:.....2.5 credits

The drawings included with the building permit application shall identify which options have been selected and the point value of each option, regardless of whether separate mechanical, plumbing, electrical, or other permits are utilized for the project

**R406.32 Additional energy efficiency requirements (Mandatory).** Each dwelling unit in a residential building shall comply with sufficient options from Table R406.2 so as to achieve the following minimum number of credits:

1. Small Dwelling Unit: .....~~1.5~~ 4.0 credits  
Dwelling units less than 1500 square feet in conditioned floor area with less than 300 square feet of fenestration area. Additions to existing building greater than 500 square feet of heated floor area but less than 1500 square feet.
2. Medium Dwelling Unit: ..... ~~3.5~~ 5.0 credits  
All dwelling units that are not included in #1, ~~or~~ #3, or #4.  
~~Exception: Dwelling units serving R-2 occupancies shall require 2.5 credits.~~
3. Large Dwelling Unit: ..... ~~4.5~~ 6.0 credits  
Dwelling units exceeding 5000 square feet of conditioned floor area.  
~~Exception: Dwelling units serving R-2 occupancies shall require 2.5 credits.~~
- ~~4. Additions less than 500 square feet: 0.5 credits~~
4. Dwelling units serving R-2 occupancies: ..... 4.5 credits (from Group R-2 Credit column in Table R406.2)
5. Additions less than or equal to 500 square feet: ... 1.5 credits

The drawings included with the building permit application shall identify which options have been selected and the point value of each option, regardless of whether separate mechanical, plumbing, electrical, or other permits are utilized for the project

**TABLE 406.2 ENERGY CREDITS**

OPTION	DESCRIPTION	CREDIT(S) R-3, Single Family and townhouse	CREDIT(S) (Group R-2, R-4)

1a	<p>EFFICIENT BUILDING ENVELOPE 1a:  Prescriptive compliance is based on Table R402.1.1 with the following modifications:  Vertical fenestration U = 0.28  Floor R-38  Slab on grade R-10 perimeter and under entire slab Below  grade slab R-10 perimeter and under entire slab</p> <p><b>or</b>  Compliance based on Section R402.1.4: Reduce the Total <a href="#">conductive<sup>a</sup></a> UA by 5%.</p>	0.5	<a href="#">N/A<sup>e</sup></a>
1b	<p>EFFICIENT BUILDING ENVELOPE 1b:  Prescriptive compliance is based on Table R402.1.1 with the following modifications:  Vertical fenestration U = 0.25  Wall R-21 <a href="#">int</a> plus R-4 <a href="#">ci</a>  Floor R-38  Basement wall R-21 <a href="#">int</a> plus R-5 <a href="#">ci</a>  Slab on grade R-10 perimeter and under entire slab Below  grade slab R-10 perimeter and under entire slab</p> <p><b>or</b>  Compliance based on Section R402.1.4: Reduce the Total <a href="#">conductive<sup>a</sup></a> UA by 15%.</p>	1.0	<a href="#">1.0</a>
1c	<p>EFFICIENT BUILDING ENVELOPE 1c:  Prescriptive compliance is based on Table R402.1.1 with the following modifications:  Vertical fenestration U = 0.22  Ceiling and single-rafter or joist-vaulted R-49 advanced  Wood frame wall R-21 <a href="#">int</a> plus R-12 <a href="#">ci</a>  Floor R-38  Basement wall R-21 <a href="#">int</a> plus R-12 <a href="#">ci</a>  Slab on grade R-10 perimeter and under entire slab Below  grade slab R-10 perimeter and under entire slab</p> <p><b>or</b>  Compliance based on Section R402.1.4: Reduce the Total <a href="#">conductive<sup>a</sup></a> UA by 30%.</p>	2.0	<a href="#">1.5</a>
1d <sup>a</sup> <a href="#">d</a>	<p>EFFICIENT BUILDING ENVELOPE 1d:<a href="#">[DJ1]</a>  Prescriptive compliance is based on Table R402.1.1 with the following modifications:  Vertical fenestration U = 0.24</p>	0.5	<a href="#">0.5</a>
<a href="#">1e</a>	<p><a href="#">EFFICIENT BUILDING ENVELOPE 1e:</a>  <a href="#">Prescriptive compliance is based on Table R402.1.1 with the following modifications:</a>  <a href="#">Vertical fenestration U = 0.18</a>  <a href="#">Ceiling and single-rafter or joist-vaulted R-60 advanced</a>  <a href="#">Wood frame wall R-21 <a href="#">int</a> plus R-16 <a href="#">ci</a></a>  <a href="#">Floor R-48</a>  <a href="#">Basement wall R-21 <a href="#">int</a> plus R-16 <a href="#">ci</a></a>  <a href="#">Slab on grade R-20 perimeter and under entire slab</a>  <a href="#">Below grade slab R-20 perimeter and under entire slab</a></p> <p><a href="#">or</a>  <a href="#">Compliance based on Section R402.1.4: Reduce the Total <a href="#">conductive<sup>a</sup></a> UA by 40%.</a></p>	<a href="#">3.0</a>	<a href="#">2.0</a>
<a href="#">1fc</a>	<p><a href="#">EFFICIENT BUILDING ENVELOPE 1f:</a>  <a href="#">Prescriptive compliance is based on Table R402.1.1 with the following modifications:</a>  <a href="#">Vertical fenestration U = 0.20</a></p>	<a href="#">1.0</a>	<a href="#">1.0</a>
2a	<p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2a:  Compliance based on R402.4.1.2: Reduce the tested air leakage to 3.0 air changes per hour maximum <a href="#">at 50 pascals</a></p> <p><a href="#">Or</a>  <a href="#">For R-2 construction, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.3 cfm/ft<sup>2</sup> maximum at 50 pascals</a></p> <p><b>and</b>  All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> <a href="#">or Section 403.8 of the International Mechanical Code</a> shall be met with a high efficiency fan(<a href="#">s</a>) (maximum 0.35 watts/cfm), not interlocked with the furnace fan (<a href="#">if present</a>). Ventilation systems using a furnace including an ECM motor are allowed, provided that they are controlled to operate at low speed in ventilation only mode.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the qualifying ventilation system <a href="#">and its control sequence of operation.</a></p>	0.5	<a href="#">1.0</a>

2b	<p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2b:  Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 2.0 air changes per hour maximum <u>at 50 pascals</u>  <u>Or</u>  For R-2 construction, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.25 cfm/ft<sup>2</sup> maximum at 50 pascals</p> <p><b>and</b></p> <p>All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> or Section 403.8 of the <i>International Mechanical Code</i> shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of <del>0.70</del> <u>0.65</u>.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.</p>	1.0	<u>1.5</u>
2c	<p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2c:  Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 1.5 air changes per hour maximum <u>at 50 pascals</u>  <u>Or</u>  For R-2 construction, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.20 cfm/ft<sup>2</sup> maximum at 50 pascals</p> <p><b>and</b></p> <p>All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> or Section 403.8 of the <i>International Mechanical Code</i> shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of <del>0.85</del> <u>0.75</u>.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.</p>	1.5	<u>2.0</u>
2d	<p><u>2d</u>  AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2d:  Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.6 air changes per hour maximum at 50 pascals  <u>Or</u>  For R-2 <del>construction</del> <u>occupancies</u>, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.15 cfm/ft<sup>2</sup> maximum at 50 pascals</p> <p><b>and</b></p> <p>All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> or Section 403.8 of the <i>International Mechanical Code</i> shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.80. Duct installation shall comply with Section R403.3.7.  To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.</p>	<u>2.0</u>	<u>2.5</u>
3a <sup>b,d</sup>	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3a:  <u>Energy Star Rated (U.S. North)</u> Gas <u>or</u> propane <del>or oil-fired</del> furnace with minimum AFUE of <del>94%</del><u>95%</u>, or <u>Energy Star Rated</u> Gas <u>or</u> propane <del>or oil-fired</del> boiler with minimum AFUE of <del>92%</del><u>90%</u></p> <p>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.</p>	<del>1.0</del> <u>0.5</u> <u>1.0</u>	<del>1.0</del> <u>0.5</u> -(No change)
3b <sup>b,d</sup>	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3b:  Air-source heat pump with minimum HSPF of <del>9</del><u>9.5</u></p> <p>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.</p>	<del>1.0</del> <u>0.5</u>	<u>N/A<sup>e</sup></u>
3c <sup>b,d</sup>	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3c:  Closed-loop ground source heat pump; with a minimum COP of 3.3</p> <p><b>or</b></p> <p>Open loop water source heat pump with a maximum pumping hydraulic head of 150 feet and minimum COP of 3.6</p> <p>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.</p>	1.5	<u>1.0</u>

3d <sup>b,d</sup>	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3d:  Ductless Split System Heat Pumps, Zonal Control: In homes where the primary space heating system is zonal electric heating, a ductless heat pump system <u>with a minimum HSPF of 10.0</u> shall be installed and provide heating to the largest zone of the housing unit.</p> <p>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.</p>	<p><u>1.0</u>  <u>1.5</u></p>	<p><u>2.01.5</u>  <u>2.0</u></p>
3e <sup>d</sup>	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3e:  Air-source heat pump with minimum HSPF of 11.0  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.</p>	<p><u>1.0</u>  <u>1.5</u></p>	<p><u>0.5NA</u></p>
3f <sup>d</sup>	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3f:  Ductless Split System Heat Pumps [DJ2]with no electric resistance heating in the primary living areas [DJ3]. A ductless heat pump system with a minimum HSPF of 10 shall be sized and installed to provide heat to entire housing unit at the design outdoor air temperature. An alternative heating source sized at a maximum of 0.5 Watts/ft<sup>2</sup> (equivalent) of heated floor area or 500 Watts, whichever is bigger [HO4], may be installed in the dwelling unit.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected, the heated floor area calculation, the heating equipment type(s), the minimum equipment efficiency, and total installed heat capacity (by equipment type). Up to 15% of the rated heating capacity of the ductless heat pump system may be permitted to be an alternative heating source [DJ5].</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected, the heating equipment type, the minimum equipment efficiency, and total installed heat capacity (divided out by equipment type) [DJ6].</p>	<p><u>1.5</u>  <u>2.0</u></p>	<p><u>2.5</u>  <u>3.0</u></p>
4	<p>HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM:</p> <p><del>All heating and cooling system components installed inside the conditioned space. This includes all equipment and distribution system components such as forced air ducts, hydronic piping, hydronic floor heating loop, convectors and radiators. All combustion equipment shall be direct vent or sealed combustion.</del></p> <p><del>For forced air ducts: A maximum of 10 linear feet of return ducts and 5 linear feet of supply ducts may be located outside the conditioned space. All metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic. If flex ducts are used, they cannot contain splices. Flex duct connections must be made with nylon straps and installed using a plastic strapping tensioning tool. Ducts located outside the conditioned space must be insulated to a minimum of R-8.</del></p> <p><u>HVAC and duct system installation shall comply with requirements of Section of R403.3.7</u></p> <p>Locating system components in conditioned crawl spaces is not permitted under this option.</p> <p>Electric resistance heat and ductless heat pumps are not permitted under this option.</p> <p>Direct combustion heating equipment with AFUE less than 80% is not permitted under this option.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and shall show the location of the heating and cooling equipment and all the ductwork.</p>	<p>1.0</p>	<p><u>N/A<sup>e</sup></u></p>

5a	<p><del>EFFICIENT WATER HEATING 5a: All showerhead and kitchen sink faucets installed in the house shall be rated at 1.75 GPM or less. All other lavatory faucets shall be rated at 1.0 GPM or less.<sup>e</sup> To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum flow rates for all showerheads, kitchen sink faucets, and other lavatory faucets.</del></p> <p><u>EFFICIENT WATER HEATING 5a: A drain water heat recovery unit(s) shall be installed, which captures waste water heat from all <b>and only</b> the showers, and has a minimum efficiency of 40% if installed for <b>equal flow</b>[DJ7] or a minimum efficiency of 52% if installed for <b>unequal flow</b>[DJ8]. Such units shall be rated in accordance with CSA B55.1 [DJ9] and be so labeled. To qualify to claim this credit, the building permit drawings shall include a plumbing diagram that specifies the drain water heat recovery units and the plumbing layout needed to install it. <del>and</del> Labels or other documentation shall be provided that demonstrates that the unit complies with the standard.</u></p>	0.5	<u>0.5</u>
5b	<p><del>EFFICIENT WATER HEATING 5b: Water heating system shall include one of the following: Gas <b>or</b> propane <del>or oil</del> water heater with a minimum EF of 0.80. <b>or</b> Water heater heated by ground source heat pump meeting the requirements of Option 3c. <b>or</b> For R-2 occupancy, a central heat pump water heater with an EF greater than 2.0 that would supply DHW to all the units through a central water loop insulated with R-8 minimum pipe insulation.</del></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>	<del>1.0</del> 0.5	<u>0.5</u>
5c	<p><del>EFFICIENT WATER HEATING 5c: Water heating system shall include one of the following: Gas <b>or</b> propane <del>or oil</del> water heater with a minimum <u>UEF</u> of 0.91 <b>or</b> 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. <b>or</b> Water heater heated by ground source heat pump meeting the requirements of Option 3c. <b>or</b> Electric heat pump water heater with a minimum EF of 2.0 and meeting the standards of NEEA's Northern Climate Specifications for Heat Pump Water Heaters.</del></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 and, for solar water heating systems, the calculation of the minimum energy savings.</u></p>	<del>1.5</del> 1.0	<u>1.0</u>



5d	<p><b>EFFICIENT WATER HEATING 5d:</b>  A drain water heat recovery unit(s) shall be installed, which captures waste water heat from all the showers, and has a minimum efficiency of 40% if installed for equal flow or a minimum efficiency of 52% if installed for unequal flow. Such units shall be rated in accordance with CSA B55.1 and be so labeled.  To qualify to claim this credit, the building permit drawings shall include a plumbing diagram that specifies the drain water heat recovery units and the plumbing layout needed to install it and labels or other documentation shall be provided that demonstrates that the unit complies with the standard.  Water heating system shall include one of the following:  For R-2 occupancy, an electric heat pump water heater with a minimum UEF of 2.0. Water heater shall supply DHW [DJ10] to one or more units. If supplying more than one unit, water loop [DJ11] shall be insulated with R-8 minimum pipe insulation.  or  Electric heat pump water heater with a minimum UEF of 2.0 and meeting the standards of NEEA's Northern Climate Specifications for Heat Pump Water Heaters [DJ12].  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.</p>	<del>0.5</del> <del>1.5</del> 1.0	2.0
5e	<p><b>EFFICIENT WATER HEATING 5e:</b>  Water heating system shall include one of the following:  For R-2 occupancy, an electric heat pump water heater with a minimum UEF of 2.6. Water heater shall supply DHW to <del>one or more</del> all units. If supplying more than one unit, water loop [DJ13] shall be insulated with R-8 minimum pipe insulation.  or  Electric heat pump water heater [DJ14] with a minimum UEF of 2.6 and meeting the standards of NEEA's Northern Climate Specifications for Heat Pump Water Heaters.  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.</p>	2.0 1.5	2.5
5f	<p><b>EFFICIENT WATER HEATING 5f:</b>  Water heating system shall include one of the following:  For R-2 occupancy, an 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 [DJ15]. Water heater shall supply DHW to one or more units. If supplying more than one unit, water loop shall be insulated with R-8 minimum pipe insulation.  or  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 the standards of NEEA's Northern Climate Specifications for Heat Pump Water Heaters.  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.</p>	<del>2.5</del> <del>2.5</del> 2.0	<del>3.0</del> <del>2.5</del> 3.0
6	<p><b>RENEWABLE ELECTRIC ENERGY:</b>  For each 1200 kWh of electrical generation per housing unit provided annually by on-site wind or solar equipment a 0.5 credit shall be allowed, up to 3 credits. Generation shall be calculated as follows:  For solar electric systems, the design shall be demonstrated to meet this requirement using the National Renewable Energy Laboratory calculator PVWATTS.  Documentation noting solar access shall be included on the plans.  For wind generation projects designs shall document annual power generation based on the following factors:  The wind turbine power curve; average annual wind speed at the site;  frequency distribution of the wind speed at the site and height of the tower.  To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall show the photovoltaic or wind turbine equipment type, provide documentation of solar and wind access, and include a calculation of the minimum annual energy power production.</p>	0.5 1.0	0.5 1.0



Z	<p><b>APPLIANCE PACKAGE:</b>  <u>All of the following appliances shall be <del>supplied</del> provided with the dwelling unit and shall meet the following standards:</u>  <u>Dishwasher – Energy Star Rated</u>  <u>Refrigerator – Energy Star Rated</u>  <u>Washing Machine – Energy Star Rated</u>  <u>Dryer – Energy Star Rated and utilizing full Heat Pump Technology</u>  <u>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall show the appliance type and provide documentation of Energy Star Compliance. At the time of inspection, all appliances shall be installed and connected to utilities. Dryer ducts and exterior dryer vent caps shall not be installed in the unit. <del>Inspector to verify</del> [DJ16]</u></p>	0.5	<del>1</del> 01.5
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- a. Conductive UA as defined by Equation 1 and 2 in Section R402.1.4.
- b. Projects using this option may not use Option 1a, 1b, ~~or~~ 1c, 1e or 1f.
- c. Projects using this option may not use Option 1a, 1b, 1c, 1d or 1e.
- d. Projects may only include credit from one space heating option, 3a, 3b, 3c, ~~or~~ 3d, 3e or 3f. When a housing unit has two pieces of equipment (i.e., two furnaces) both must meet the standard to receive the credit.
- e. ~~Plumbing Fixtures Flow Ratings. Low flow plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following requirements:~~
  1. ~~Residential bathroom lavatory sink faucets: Maximum flow rate – 3.8 L/min (1.0 gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1.~~
  2. ~~Residential kitchen faucets: Maximum flow rate – 6.6 L/min (1.75 gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1.~~
  3. ~~Residential showerheads: Maximum flow rate – 6.6 L/min (1.75 gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1.~~

## Purpose of code change:

The Washington State Legislature crafted the energy code enabling legislation (RCW 1927a) to show its intention to develop a carbon neutral building requirement by 2031. This took the form of a 70% reduction in the total energy use of new building built under that code. To date the SBCC and the various code changes have focused on the energy use and the metric to track progress toward that goal. In the 2018 code edits to the commercial energy code the SBCC approved a “carbon emissions” accounting to be used to assess buildings built under the performance path and HVAC systems built under the prescriptive path. Since these approaches are based on energy simulations they are only partly applicable to the residential energy code. This code change revises the option table to include a more accurate accounting of the carbon emissions based on the table passed for the commercial code (C403.3(1)). ~~and based on the relative emissions of the various fuel types.~~

This code change parallels another code change proposal that modifies and extends the R406 option table based purely on energy efficiency and site energy. The content of that option table is substantially the same. The added change here is to reset the some of the option points based on the impact of the options on carbon emissions of the particular option, of the energy used in the dwelling unit. The revisions in the prescriptive code and in the descriptions and specifications in the option table are unchanged.

The carbon accounting is drawn from the carbon emissions table developed and passed for the commercial energy code. This table has been reproduced in the residential code in section R405 and is directly applicable to the results of any performance runs used to show compliance. The table was then used to assess the option table and correct for the changes that the carbon accounting would make in the option points. The change proposal develops a “fuel normalization” table (R406.1) to ~~to~~ equalize the carbon emissions between chosen fuel types. The option points are altered where direct fuel consumption is credited specifically efficient gas furnaces and heat pumps.

Since this proposal modifies another proposal, the goals of that proposal are included. These include:

**Incremental Improvements in Energy Efficiency consistent with RCW 19.27a.160:** Specifically these changes add additional option points necessary to meet the requirements of the Washington residential energy code. The additional points in this proposal and in the parallel proposal are designed to equalize the requirement across the residential sector. The additional points are required to bring the standards for smaller dwelling units to the same level as the present requirements for the single family homes.

- **Change in Scope:** Because this code covers multi-family construction and additions as well as single family homes, ~~we have added~~ these applications have been added explicitly to Section R406. This step was necessary to facilitate an equalization between the multi-family occupancies and the other residential occupancies. To facilitate the options for tighter envelopes in the multifamily sector changes have been proposed to the section R402.4.2.1 testing standard to allow building officials and proposers more flexibility is establishing compliance with the air tightness requirements.
- **Other changes in the prescriptive code:** ~~We have also added a~~ few prescriptive code changes have been added to strengthen and clarify the requirements set out in Section R406. These include a detailed description of the requirements for interior ducts (R403.3.7) and revisions to the testing specification in R402.4.2.1.
- **Changes to Table R-406 Options:** There are several changes to the option table. Some of these changes have been modified to be consistent with the carbon emissions table. To provide clear enforceable code language, several editorial changes have been included. Low flow fixtures have been mandated through the legislature, therefore cannot be awarded as an energy credit under R406 – this has been eliminated from the table
- **Fuel Normalization Table (R406.1).** This table is designed to adjust the ~~emission~~ emissions factors so that the initial fuel selection can be equalized. The table has been designed to normalize all fuels with respect to a gas furnace system that uses federal minimum efficiency standards. In general, homes with heat pump systems are given extra points and homes with electric resistance systems are penalized. The results of this table partially offset the point requirements necessary for compliance with the R406.2 option table. ~~To provide some context for the code changes to section 406, this section provides some background on the process that went in to developing this~~

~~solution.~~

~~Consider clarifications and implementation changes.~~ To provide clear enforceable code language, several editorial changes have been included. We have pulled/moved many of the requirements related to option 4 into the base code to clarify requirements and make this section referable in other sections of the code. Low flow fixtures have been mandated through the legislature, therefore cannot be awarded as an energy credit under R406 — this has been eliminated from the table for 2018.

- **Add New Efficiency Options and changes in points to reflect carbon emissions:** To continue to provide a diverse set of options for implementation, several new options have been added.
  - Option 1e provides credit for 40% UA reduction
  - Option 1f provides credit for higher performing triple pane glazing
  - Option 2d allows credit for tighter envelope construction and top-tier ERVs
  - Option 3a reduces credit for high efficiency gas reflecting lower carbon emissions.
  - Option 3e provides credit for variable speed central-split system heat pumps and increases the points to reflect the reduced carbon impact of these options.
  - Option 3f allows credit for homes with primarily heat pump heating. Eliminating much of electric resistance heating leads to increased energy savings. The impact on multifamily allows an increase in points for DHPs in that sector
  - Option 5d, e, f are expanded to more thoroughly cover heat pump water heating options
  - 5e increases the points available for central heat pump water heaters in the multi-family sector
  - Option 7 gives credit for appliances (primarily heat pump dryers). An energy end-use that has been neglected in the code. the electric savings from heat pump dryers allow an extra half point for the package in the multi-family sector.

~~Consider-Integrate the Impact of Federal Standards:~~ Changes to federal equipment standards have two impacts. First, federal equipment is mandatory in all cases, resulting in implementation of these upgrades in the base code. Second, the federal standards impact in incremental improvement of any efficiency upgrades provided [DJ18] in table R406.

- 3a, anticipated federal standards for gas and propane furnaces were rescinded. The base case is lower, and as a result the incremental improvement for this equipment is better. The credit for this measure is changed from .5 to 1.
- 3b, new federal standards for heat pumps has changed from 7.8 HSPF to 8.2 HSPF. To adjust for this change, the ~~HAPF-HSPF~~ required gaining to qualify for this credit changes from HSPF 8 to HSPF 9.
- 5, Federal standards for water heating equipment were adopted and will be implemented in April 2015. This brings upraises the baseline for all equipment. This requires the elimination of some equipment options and changes in the incremental credits provided for the remaining options.

**Calculate Building Energy Use for the base code and section 406 options:** The base code changes made in 2015 and by the 2018 IECC additions, along with WA state law, are first assessed to determine the base energy use of the prototype buildings. This ultimately impacts the credit provided by Section R406 options. For example, WA state law mandating low-flow fixtures reduces the savings potential from water heating equipment efficiencies – thus lowering their effective value. The savings attributed to low-flow fixtures are not ‘lost’ in the analysis however, as the energy savings is now reflected in the 2018 baseline (prescriptive) energy use of the residential sector. Based on this, the value of each credit is reassessed and if needed, reassigned.

~~Adjust the targets for systems analysis approach, section 405.3. The last~~ This step is to place a parallel carbon accounting in the performance path and include a reduced energy target consistent with previous code changes. ~~assess the performance-based approach.~~ The targets for single family homes have been reduced by an additional 10 percent.

~~Asses-Assess~~ **the number of credits required to achieve the objectives of RCW 19.27a.160.** This proposal is designed to meet the high level goal included in the SBCC 2012 WASHINGTON STATE ENERGY CODE LEGISLATIVE REPORT. This is 64% of the energy use of a home constructed to the 2006 state energy code. This work is reflected in the credits required to comply with code in Section R406.2. [DJ19]

~~Adjust the targets for systems analysis approach, section 405.3. The last step is to assess the performance-based approach. The targets for single family homes have been reduced by an additional 10 percent.~~

Your amendment must meet one of the following criteria. Select at least one:



STATE OF WASHINGTON

## STATE BUILDING CODE COUNCIL

- |  |  |
|--|--|
| <input type="checkbox"/> Addresses a critical life/safety need.  | <input checked="" type="checkbox"/> Consistency with state or federal regulations. |
| <input type="checkbox"/> The amendment clarifies the intent or application of the code.  | <input type="checkbox"/> Addresses a unique character of the state.                |
| <input checked="" type="checkbox"/> Addresses a specific state policy or statute.<br>(Note that energy conservation is a state policy) | <input type="checkbox"/> Corrects errors and omissions.                            |

Check the building types that would be impacted by your code change:

- |   |   |  |
|---|---|--|
| <input checked="" type="checkbox"/> Single family/duplex/townhome | <input type="checkbox"/> Multi-family 4 + stories | <input type="checkbox"/> Institutional |
| <input checked="" type="checkbox"/> Multi-family 1 – 3 stories    | <input type="checkbox"/> Commercial / Retail      | <input type="checkbox"/> Industrial    |

Your name [Click here to enter text.](#)

Email address [Click here to enter text.](#)

Your organization [Click here to enter text.](#)

Phone number [Click here to enter text.](#)

Other contact name [Click here to enter text.](#)

**Instructions:** Send this form as an email attachment, along with any other documentation available, to: [sbcc@des.wa.gov](mailto:sbcc@des.wa.gov). For further information, call the State Building Code Council at 360-407-9278.

## **Economic Impact Data Sheet**

Briefly summarize your proposal's primary economic impacts and benefits to building owners, tenants and businesses.

The proposal delivers similar total energy savings to the alternative proposal for R406. This proposal, however, recasts these savings to maximize the carbon emissions for the energy savings realized by the R406 option table. The result is a series of cost-effective approaches to reducing the energy impact of new homes by about 9% (of the 2006 energy code baseline, RCW1927a) the savings remain the same for this proposal although the carbon adjustments, while modest, enhance the impact of this table on carbon emissions. While these savings sustain progress toward the overall goal of 70% energy reduction the added feature is that the revised option table encourages the use of more efficient envelope measures or more efficient heat pump measures that offset the gas consumption of typical homes. Example #1 (attached) the an additional envelope measure and addition air tightness result in a 35% reduction in Carbon over the prescriptive path and an additional 6% reduction over the proposed options using the existing site energy accounting. In all cases the resulting packages deliver cost effective savings using the OFM lifecycle cost analysis tool.

The results of the lifecycle cost analysis are attached in separate files for each example evaluated:

1. Medium Gas home: Baseline 2015 code, Alt 1: 2018 Proposed Options, Alt 2: 2018, Proposed Carbon Accounting;
2. Small Gas home: Baseline 2015 code, Alt 1: 2018 Proposed Options, Alt 2: 2018, Proposed Carbon Accounting;
3. Medium HP home: Baseline 2015 code, Alt 1: 2018 Proposed Options, Alt 2: 2018, Proposed Carbon Accounting;
4. Small Elect. Home: Baseline 2015 code, Alt 1: 2018 Proposed Options, Alt 2: 2018, Proposed Carbon Accounting;
5. MF Zonal: Baseline 2015 code, Alt 1: 2018 Proposed Options, Alt 2 2018, Proposed Carbon Accounting.

The results of these runs are summarized in tables 1 2 and 3. In all cases the NPV results show a positive value for all options analyzed. The Tables also include a simple payback calculation based on current energy costs and estimated construction costs of the proposed alternatives.

[inset summary tables]

Provide your best estimate of the construction cost (or cost savings) of your code change proposal? (See OFM Life Cycle Cost [Analysis tool](#) and [Instructions](#); use these [Inputs](#). **Webinars on the tool can be found [Here](#) and [Here](#)**)

**These values will come from the runs weighted among the 3 prototypes (TBD)**

Click here to enter text./square foot (For residential projects, also provide Click here to enter text./dwelling unit)

Show calculations here, and list sources for costs/savings, or attach backup data pages

Provide your best estimate of the annual energy savings (or additional energy use) for your code change proposal?

Click here to enter text.KWH/ square foot (or) Click here to enter text.KBTU/ square foot

(For residential projects, also provide Click here to enter text.KWH/KBTU / dwelling unit)

Show calculations here, and list sources for energy savings estimates, or attach backup data pages

List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

**All questions must be answered to be considered complete. Incomplete proposals will not be accepted.**

**All questions must be answered to be considered complete. Incomplete proposals will not be accepted.**