



STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

Washington State Energy Code Development Standard Energy Code Proposal Form

066
Proponent Revision
Received 6/01/22
TAG Modification
6/03/22

Code being amended: Commercial Provisions Residential Provisions

Code Section # R403.5, R405.2, R503.1.3

Brief Description:

This code proposal would require new residential buildings to install heat pump water heaters for domestic hot water heating.

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.)

Modify the section as follows:

R403.5 Service hot water systems. Energy conservation measures for service hot water systems shall be in accordance with ~~Sections R403.5.1 through R403.5.3~~ this section.

Add new section as follows:

R403.5.4 Heat pump water heating. Service hot water in one- and two-family dwellings and multiple single-family dwellings (townhouses) shall be provided by an electric heat pump system. The heat pump water heating system shall be sized to provide 100 percent of peak hot water demand. Where the heat pump is located in unconditioned space, the heat pump water heating system shall be sized to provide 100 percent of peak hot water demand at an entering source dry bulb (or wet bulb if rated for wet bulb temperatures) air temperature of 40°F (4°C).

Exceptions

1. Resistance heating elements integrated into heat pump equipment.
2. Electric water heaters with a rated water storage volume of no greater than 20 gallons.
- ~~2.3. Dwelling units with no more than 1,000 square feet of conditioned floor area.~~
- ~~3.4. Supplementary water heating systems in accordance with R403.5.4.1, provided the system capacity does not exceed the capacity of the heat pump water heating system.~~
- ~~4. Water heating systems that serve end uses that require water temperature of 180°F (82°C) or hotter.~~
5. Solar water heating systems
6. Waste heat and energy recovery systems
7. Heat trace freeze protection systems.
8. Snow and ice melt systems.
- ~~9. Other water heating systems as approved.~~

R403.5.4.1 Supplementary heat for heat pump water heating systems. Heat pumps used for water heating and having supplementary water heating equipment shall have controls that limit supplemental-supplementary water heating equipment operation to only those times when one of the following applies:

1. The heat pump water heater cannot meet hot water demand.
- ~~1.2.~~ For heat pumps located in unconditioned space, the outside air temperature is below 40°F (4°C).

2.3. The heat pump is operating in defrost mode.

3.4. The vapor compression cycle malfunctions or loses power.

Exception: Heat trace temperature maintenance systems, provided the system capacity does not exceed the capacity of the heat pump water heating system.

Modify Table R405.2 as follows:

Systems	
R403.1	Controls
R403.1.2	Heat pump supplemental heat
R403.3.2	Sealing
R403.3.1	Equipment and system sizing
R403.3.3	Duct testing
R403.3.4	Duct leakage
R403.3.5	Building cavities
R403.4	Mechanical system piping insulation
R403.5.1	Heated water circulation and temperature maintenance system
<u>R403.5.4</u>	<u>Heat Pump Water Heating</u>
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt system controls
R403.10	Pool and permanent spa energy consumption
R403.11	Portable spas

Modify Table R406.2 as follows:

<u>System Type</u>	<u>Description of Primary Heating Source</u>	<u>Credits</u>	
		<u>R-3</u>	<u>R-2</u> <u>All other</u>
<u>1</u>	<u>For combustion space heating system using 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 space 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) 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>3.0</u> <u>2.0</u>	<u>2.0</u> <u>1.0</u>
<u>3</u>	<u>When dwelling unit is located in climate zone 4C (as shown in Table R301.1) with a primary space heating system using a heat pump that meets federal standards for the equipment listed in C403.3.2(2) and a secondary heating provided by a combustion furnace meeting minimum standard listed in Table C403.3.2(4)*</u> <u>or</u> <u>When dwelling unit is located in climate zone 5B (as shown in Table R301.1) with a primary space heating system using a heat pump that meets federal standards for the equipment listed in C403.3.2(2) and a secondary heating provided by a combustion furnace meeting minimum standard listed in Table C403.3.2(4)*</u>	<u>1.5</u> <u>1.0</u>	<u>0</u>

4	<u>For space 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>2.0</u> <u>1.5</u>	<u>0</u>
5	<u>For space heating system based on electric resistance only (either forced air or Zonal)</u>	<u>0.5</u>	<u>-0.5</u>
6	<u>For combustion water heating system using equipment meeting minimum federal efficiency standards for the equipment listed in Table C404.2.</u>	<u>0</u>	<u>0</u>
7	<u>For an initial water heating system using a heat pump that meets federal standards for the equipment listed in Table C404.2</u>	<u>1.0</u>	<u>1.0</u>
8	<u>For a water heating system based on electric resistance only</u>	<u>0.5</u>	<u>-0.5</u>

Modify the section as follows:

R503.1.3 Service hot water systems. New service hot water systems that are part of the alteration shall comply with Section R403.5.

Exception: Replacements of water heating equipment shall not be required to comply with Section R403.5.4 where the rated capacity of the new equipment does not exceed the rated capacity of the existing equipment.

Reason for revisions

We met with several interested parties who expressed concerns with the proposal. We addressed as many of those concerns as possible by making the following edits to the proposal:

- There was a concern that individual HPWHs would be difficult to implement in low-rise multifamily developments due to the impacts on unit layout, the additional space, and the additional cost beyond the HPWH that may be required for venting to address sound and access to heat. An additional concern was raised that the fuel normalization table was effective at influencing market transformation while still allowing flexibility. Therefore, the proposal was modified as follows:
 - The proposal was revised so that it only applies to one- and two- family homes and townhouses and not any other R-occupancy. An exception for dwelling units under 1000 sf was added since those homes (such as ADUs and tiny houses) would face the same issues as multifamily dwellings. It allowed for the high temperature exception to be removed since that is not applicable to these building types.
 - The new fuel normalization table from proposal 073 approved by the TAG on 5/27 was modified. The table assumes that water heating will follow space heating in terms of fuel. Even if this assumption is accurate, it does not take into account resistance WH vs HPWH. The modifications to the table split the points for space and water heating to further incentivize water heating electrification and HPWHs in occupancies that are not required to have them under this proposal.
- There was a concern that the proposal completely eliminated natural gas options, particularly in light of the increasing availability of natural gas heat pumps and the potential need to have hot water during a power outage. As the proposal is focused primarily on efficiency, it was revised so that either an electric or gas heat pump can be used to meet the requirement.
- There was a concern about HPWHs being able to meet hot water demand for larger families. The proposal was updated to clarify that inability to meet demand was an acceptable condition for supplementary water heating equipment operation.
- There was a concern that the “other systems as approved” was too broad, so it was eliminated.

Original Reason Statement

Purpose of code change:

Requiring water heating to be all-electric eliminates a significant source of fossil fuel combustion in buildings, and is generally 2-4x more energy efficient than either fossil fuel or electric resistance heating. This proposal aligns with [State policy to increase energy efficiency](#) by 70% by 2031. Additionally, this proposal will significantly reduce emissions and is aligned with [State policy to achieve the broader goal](#) of building zero fossil-fuel greenhouse gas emission homes and buildings by the year 2031. According to analysis done using data from the 2021 Washington State Energy Strategy, we need to reduce the commercial buildings sector emissions by 44% to keep on track to meet our 2050 climate goals. The State also needs to increase the proportion of annual sales of heat pumps from 0.4% of all residential water heating equipment in 2020 to 55% by 2030, a growth of 130x. To get to this increase in market penetration of heat pumps, the Washington State Energy Code should require all residential water heating to be all-electric in the 2021 code cycle. See Supplemental Attachment for further details on economics, emissions reduction and market penetration.

What the proposal does:

The proposal adds a new section that requires that water heating be provided by electric heat pump equipment. It includes key exceptions to foster flexibility, usability and enforceability:

- It exempts electric resistance water heaters with storage tanks smaller than 20 gallons since there are no heat pump models available for these small sizes. A typical 30 gallon electric resistance water heater would generally be replaced by a 40 gallon heat pump water heater (HPWH), so these are not exempted. This exemption would also exempt point-of-use electric water heaters. While it is conceivable that a project could choose a very large electric resistance point-of-use water heater instead of a HPWH, the electrical capacity and cost implications of this decision make it unlikely enough on practical terms that it does not need to be addressed.
- It is explicit that the resistance heating elements that are integrated into HPWHs, solar thermal systems, waste heat and energy recovery systems, freeze protection systems and snow and ice melt systems are not impacted by this new language. Some of these exceptions are not strictly necessary, but they have been included to improve the clarity and usability of the code.
- It allows supplementary heat in accordance with a new water heating supplementary heat section discussed below.

The proposal adds a new section for supplementary water heating that is modeled on the existing section for supplementary space heating for heat pumps in the model IECC and adapted for the specifics of HPs used for water heating.

The proposal then has language in section R503 to ensure that these requirements would not apply to simple equipment replacements. The exception is configured so that it is only available when new equipment is the same size as the equipment being replaced. This ensures that the new requirements will not trigger an electrification retrofit for equipment replacement unless it is a major system reconfiguration with a larger piece of equipment.

This proposal does not impact larger, more complex systems that serve multiple dwelling units since those systems are already referred to the commercial section of the code by R403.8.

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

Addresses a critical life/safety need.

The amendment clarifies the intent or application of the code.

Addresses a specific state policy or statute.
(Note that energy conservation is a state policy)

Addresses a unique character of the state.

Corrects errors and omissions.

Consistency with state or federal regulations.

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

Single family/duplex/townhome

Multi-family 4 + stories

Institutional

Multi-family 1 – 3 stories

Commercial / Retail

Industrial

Your name Sean Denniston

Email address sean@newbuildings.org

Your organization NBI

Phone number 503-481-7253

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

Economic Impact Data Sheet

Is there an economic impact: Yes No

Briefly summarize your proposal's primary economic impacts and benefits to building owners, tenants, and businesses. If you answered "No" above, explain your reasoning.

Construction costs for heat pump water heaters are often, but not always, higher than for conventional natural gas or electric resistance water heaters. When eliminating the cost of gas infrastructure running to the building and the cost of a separate air conditioner for space cooling, all-electric homes are generally less expensive than mixed fuel homes. Annual energy costs for heat pump water heaters are much lower than for electric resistance heating, but comparable with gas heating, at current rates (World Bank long term forecasts indicate an increase of over 80% in gas prices over the coming decade.) When including the Washington State social cost of carbon, heat pump water heating is more cost effective than both gas water heating and electric resistance water heating over the life cycle analysis horizon.

Given the state's climate goals and policy, this Energy Code proposal will help ensure new assets permitted beginning July 1, 2023 will not need to be immediately retrofitted.

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](#)**)

Upfront cost savings is -\$0.27/ sq ft or -\$646 per home. Note that negative savings means it has a cost.

The life cycle cost savings, not including the social cost of carbon, is -\$0.28/ sq ft or -\$674 per home.

The life cycle cost savings, including the social cost of carbon, is \$0.42/ sq ft or \$1,016 per home.

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

See attached supplemental.

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

Annual energy savings of 3.2 kBTU/ sq ft

Annual energy savings of 7,680 kBTU per home

(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:

Instructions: Send this form as an email attachment, along with any other documentation available, to: sbcc@des.wa.gov. For further information, call the State Building Code Council at 360-407-9255.

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

No increase in plan review or inspection time.

Small Business Impact. Describe economic impacts to small businesses:

No impact on small businesses, since this is the residential code.

Housing Affordability. Describe economic impacts on housing affordability:

Small impact on housing affordability if the builder decides to not build all-electric which would save them money.

Other. Describe other qualitative cost and benefits to owners, to occupants, to the public, to the environment, and to other stakeholders that have not yet been discussed:

Improve air quality and reduce greenhouse gas emissions.

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