



STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

Washington State Energy Code Development Standard Energy Code Proposal Form

May 2018

Log No. 19-WSEC-R27

Code being amended: Commercial Provisions Residential Provisions

Code Section # 402.4.2

Brief Description:

This proposal establishes a minimum efficiency performance threshold for fireplaces based on the Canadian FE Standard. (<https://www.nrcan.gc.ca/energy/products/energuide/label/reading/13718>). We suggest using the FE metric in lieu of AFUE because it more accurately reflects annual heating consumption of the fireplace (taking into account cycling losses, heating and non-heating season efficiency, pilot light contribution, etc.) The standard assesses all gas fireplaces, whether they are decorative units or are used for space heating. It is an accurate measurement that reflects the overall operation of the fireplace, taking into account its use and performance throughout the entire heating season.

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.)

R402.4.2.1 Gas Fireplace Efficiency. All natural-gas fireplaces designed to heat indoor space and/or provide aesthetic appeal (decorative) shall be listed and labeled with a fireplace efficiency (FE) rating of 65% or greater in accordance with CSA P.4.1-15.

Exception: Gas fireplaces that have a rated output < 9,000 btu/h.

Purpose of code change:

Code does not currently address gas fireplace efficiency, (though section 402.4.2 does reference safety standards for wood-burning fireplaces). Gas-burning fireplaces have a wide range of efficiency levels, from 28% to 90% and greater. Gas-fireplaces are most commonly used as secondary heating sources but may still be used for a significant number of hours per heating season. This proposal would create a minimum efficiency level for all gas-fireplaces installed in new homes to meet in line with regional utility program requirements that have been in place for years.

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)
- Consistency with state or federal regulations.
- Addresses a unique character of the state.
- Corrects errors and omissions.

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 Nicholas O'Neil

Email address noneil@energy350.com

Your organization Energy 350

Phone number 503-333-8161

Other contact name Louis Starr

Economic Impact Data Sheet

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

Since gas fireplaces can operate for a significant number of hours per year, using an efficient fireplace over an industry standard fireplace can save a significant amount. The primary economic benefit to the homeowner is lower gas bills during the heating season by using a fireplace that consumes gas in a more efficient manner compared to a market baseline unit.

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](#))

\$0.07 /square foot (based on 2,200 square foot house) (For residential projects, also provide \$147 / dwelling unit)

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

Costs were based on data from the Energy Trust of Oregon residential gas hearth program and the EERE Technical Support Document on gas hearths. There are no added construction or installation costs as the installation of an efficient and non-efficient gas-fireplace is similar. An incremental cost of \$147 was found based on an analysis for pilot light configurations and model costs for 65% FE equipment in regional utility programs.

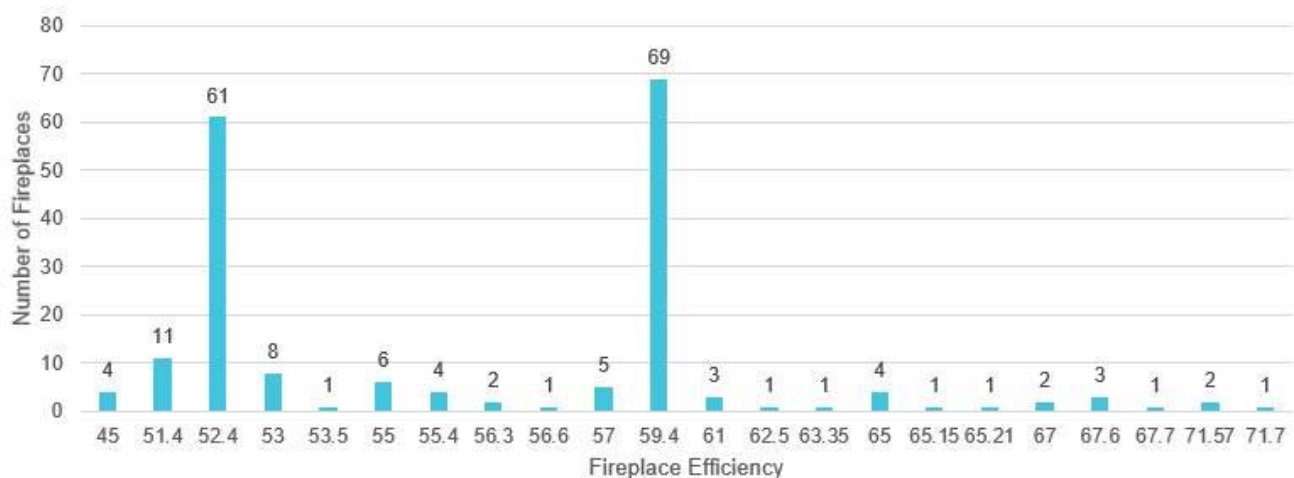
Provide your best estimate of the annual energy savings (or additional energy use) for your code change proposal?

0 KWH/ square foot (or) 0.85 KBTU/ square foot (based on 2,200 square foot house)

(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

Savings are based on the difference between a baseline fireplace and a target efficiency level. We determined the baseline FE score based on recent market characterization studies from the Energy Trust of Oregon in their new homes program. A distribution of fireplace efficiencies from 192 homes in that program is shown in the chart below.



Based on this distribution, a weighted average efficiency level of 56.5% FE was chosen as a representative baseline, which comprises approximately 50% of the market.

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

To establish a target efficiency level, we conducted an analysis of available products in the NRCAN database across varying fireplace types, excluding those with standing/continuous pilot ignition and only products that met or exceeded the baseline efficiency level of 56.5% FE. Only unique models were considered in the analysis, eliminating duplicate models that had different product names but were effectively had the same efficiency level, size, and configuration. The mean and median of each fireplace meeting this criteria in the database type is shown in the table below as well as the count of unique manufacturers and models available at those levels.

Configuration	Mean Efficiency FE Score	Median Efficiency FE Score	Unique Manufacturer Count (Mean)	Unique Model Count (Mean)
Freestanding Fireplaces	70.0	69.7	21	73
Insert Fireplaces	69.8	70.7	29	138
Zero Clearance Fireplaces	65.6	65.0	35	395
Any Configuration	67.1	66.5	46	606

As the mean and median values are close, we relied on the mean for this analysis. We discovered slight differences in mean efficiency levels between unit configurations, however a single efficiency level of 65% FE was chosen across all configurations as the target efficiency level to simplify the code requirement and include all model configurations as eligible.

To determine the annual hours of use, we relied on Energy Trust of Oregon’s 2017 survey responses to a question about hours of use for fireplace users. “Fireplace users” are considered people who have a fireplace and reported using it at least 0 hrs. (excludes “no use” & “haven’t used yet”).

Method	Fireplace Users > 0 hr. Use
Mean	11.5 hrs.
Median	5.5 hrs.
Sample Size	n=222

For purposes of savings calculations we used the median value of 5.5 hours per week for the heating season (estimated at 35 days from October – May) which translates to 190 hours per year of use.

Savings can be calculated using the following equation:

$$\Delta therm = hr \times \frac{kBtu}{hr} \times \left(\frac{1}{baseline} - \frac{1}{FE} \right)$$

The weighted average equipment size for efficient fireplaces (i.e. ≥ 65% FE) is 18 kbtuh and the weighted average equipment size for fireplaces below that threshold is 21.5 kbtuh. Using the equation above and a baseline of 56.5% FE and a target efficiency of 65% FE, a savings of **18.9 therms/yr** is calculated.

Using Washington State data from the 2016 RBSA, mean space heat for a home in Washington was 557.5 therms/yr and used as the baseline gas consumption. Savings of 18.9 therms were subtracted from that baseline usage in the associated lifecycle cost tool.

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

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

Additional review time will be minimal as the code official would need to see the rated FE score on the equipment plans. Inspectors would follow a procedure akin to inspecting gas furnaces that meet the efficiency requirements of the code. On-site verification of FE rating is all that is required.

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

Office of Financial Management
 Olympia, Washington - Version: 2018-Residential
 Life Cycle Cost Analysis Tool
Executive Report

Project Information	
Project:	
Address:	
Company:	Energy 350
Contact:	Nicholas O'Neil
Contact Phone:	503-333-8161
Contact Email:	noneil@energy350.com

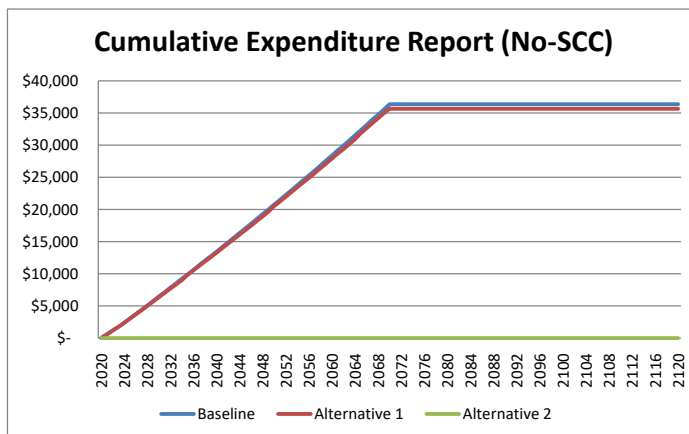
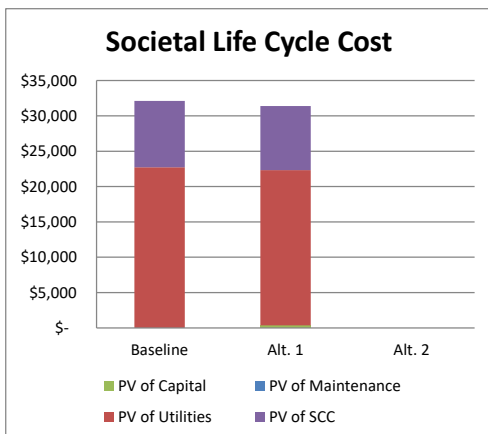
Key Analysis Variables		Building Characteristics	
Study Period (years)	50	Gross (Sq.Ft)	2,200
Nominal Discount Rate	5.00%	Useable (Sq.Ft)	2,200
Maintenance Escalation	1.00%	Space Efficiency	100.0%
Zero Year (Current Year)	2020	Project Phase	0
Construction Years	0	Building Type	0

Life Cycle Cost Analysis		BEST	
Alternative	Baseline	Alt. 1	Alt. 2
Energy Use Intensity (kBtu/sq.ft)	25.3	24.5	
1st Construction Costs	\$ -	\$ 147	\$ -
PV of Capital Costs	\$ -	\$ 363	\$ -
PV of Maintenance Costs	\$ -	\$ -	\$ -
PV of Utility Costs	\$ 22,723	\$ 21,952	\$ -
Total Life Cycle Cost (LCC)	\$ 22,723	\$ 22,315	\$ -
Net Present Savings (NPS)	N/A	\$ 407	\$ -

Societal LCC takes into consideration the social cost of carbon dioxide emissions caused by operational energy consumption

(GHG) Social Life Cycle Cost		BEST	
GHG Impact from Utility Consumption	Baseline	Alt. 1	Alt. 2
Tons of CO2e over Study Period	148	143	-
% CO2e Reduction vs. Baseline	N/A	3%	104%
Present Social Cost of Carbon (SCC)	\$ 9,398	\$ 9,079	\$ -
Total LCC with SCC	\$ 32,121	\$ 31,395	\$ -
NPS with SCC	N/A	\$ 726	\$ -

Warning: OFM Assigned Variables Not Used



Baseline Short Description
Alternative 1 Short Description
Alternative 2 Short Description

Cumulative Expenditure Summary				Annual Expenditure Summary		
Year	Baseline	Alt. 1	Alt. 2	Baseline	Alt. 1	Alt. 2
2020	\$ -	\$ -	\$ -	\$ -	\$ 29	\$ -
2021	\$ 592	\$ 609	\$ -	\$ 592	\$ 579	\$ -
2022	\$ 1,178	\$ 1,182	\$ -	\$ 586	\$ 574	\$ -
2023	\$ 1,765	\$ 1,756	\$ -	\$ 586	\$ 573	\$ -
2024	\$ 2,403	\$ 2,379	\$ -	\$ 639	\$ 624	\$ -
2025	\$ 3,071	\$ 3,031	\$ -	\$ 668	\$ 651	\$ -
2026	\$ 3,738	\$ 3,682	\$ -	\$ 668	\$ 651	\$ -
2027	\$ 4,411	\$ 4,339	\$ -	\$ 673	\$ 657	\$ -
2028	\$ 5,085	\$ 4,995	\$ -	\$ 673	\$ 656	\$ -
2029	\$ 5,770	\$ 5,662	\$ -	\$ 685	\$ 667	\$ -
2030	\$ 6,460	\$ 6,335	\$ -	\$ 691	\$ 673	\$ -
2031	\$ 7,151	\$ 7,008	\$ -	\$ 691	\$ 673	\$ -
2032	\$ 7,842	\$ 7,681	\$ -	\$ 691	\$ 673	\$ -
2033	\$ 8,533	\$ 8,353	\$ -	\$ 691	\$ 672	\$ -
2034	\$ 9,229	\$ 9,031	\$ -	\$ 697	\$ 678	\$ -
2035	\$ 9,926	\$ 9,856	\$ -	\$ 697	\$ 825	\$ -
2036	\$ 10,628	\$ 10,539	\$ -	\$ 702	\$ 683	\$ -
2037	\$ 11,330	\$ 11,222	\$ -	\$ 702	\$ 683	\$ -
2038	\$ 12,039	\$ 11,911	\$ -	\$ 708	\$ 689	\$ -
2039	\$ 12,747	\$ 12,599	\$ -	\$ 708	\$ 688	\$ -
2040	\$ 13,461	\$ 13,293	\$ -	\$ 714	\$ 694	\$ -
2041	\$ 14,175	\$ 13,987	\$ -	\$ 714	\$ 694	\$ -
2042	\$ 14,894	\$ 14,686	\$ -	\$ 720	\$ 699	\$ -
2043	\$ 15,614	\$ 15,385	\$ -	\$ 720	\$ 699	\$ -
2044	\$ 16,340	\$ 16,090	\$ -	\$ 726	\$ 705	\$ -
2045	\$ 17,065	\$ 16,794	\$ -	\$ 726	\$ 705	\$ -
2046	\$ 17,797	\$ 17,504	\$ -	\$ 731	\$ 710	\$ -
2047	\$ 18,534	\$ 18,220	\$ -	\$ 737	\$ 716	\$ -
2048	\$ 19,271	\$ 18,935	\$ -	\$ 737	\$ 715	\$ -
2049	\$ 20,012	\$ 19,654	\$ -	\$ 741	\$ 719	\$ -
2050	\$ 20,756	\$ 20,523	\$ -	\$ 744	\$ 869	\$ -
2051	\$ 21,504	\$ 21,245	\$ -	\$ 748	\$ 722	\$ -
2052	\$ 22,255	\$ 21,971	\$ -	\$ 751	\$ 726	\$ -
2053	\$ 23,009	\$ 22,700	\$ -	\$ 755	\$ 729	\$ -
2054	\$ 23,767	\$ 23,432	\$ -	\$ 758	\$ 732	\$ -
2055	\$ 24,529	\$ 24,168	\$ -	\$ 762	\$ 736	\$ -
2056	\$ 25,294	\$ 24,907	\$ -	\$ 765	\$ 739	\$ -
2057	\$ 26,062	\$ 25,649	\$ -	\$ 769	\$ 742	\$ -
2058	\$ 26,834	\$ 26,395	\$ -	\$ 772	\$ 746	\$ -
2059	\$ 27,610	\$ 27,145	\$ -	\$ 775	\$ 749	\$ -
2060	\$ 28,389	\$ 27,897	\$ -	\$ 779	\$ 753	\$ -
2061	\$ 29,171	\$ 28,653	\$ -	\$ 782	\$ 756	\$ -
2062	\$ 29,957	\$ 29,412	\$ -	\$ 786	\$ 759	\$ -
2063	\$ 30,747	\$ 30,175	\$ -	\$ 789	\$ 763	\$ -
2064	\$ 31,540	\$ 30,941	\$ -	\$ 793	\$ 766	\$ -
2065	\$ 32,336	\$ 31,857	\$ -	\$ 796	\$ 916	\$ -
2066	\$ 33,136	\$ 32,630	\$ -	\$ 800	\$ 773	\$ -
2067	\$ 33,939	\$ 33,406	\$ -	\$ 803	\$ 776	\$ -
2068	\$ 34,746	\$ 34,186	\$ -	\$ 807	\$ 779	\$ -
2069	\$ 35,556	\$ 34,969	\$ -	\$ 810	\$ 783	\$ -
2070	\$ 36,370	\$ 35,657	\$ -	\$ 814	\$ 688	\$ -
2071	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2072	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2073	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2074	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2075	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2076	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2077	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2078	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2079	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2080	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2081	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2082	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2083	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2084	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2085	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2086	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2087	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -

Cumulative Expenditure Summary				Annual Expenditure Summary		
Year	Baseline	Alt. 1	Alt. 2	Baseline	Alt. 1	Alt. 2
2088	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2089	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2090	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2091	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2092	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2093	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2094	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2095	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2096	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2097	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2098	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2099	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2100	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2101	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2102	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2103	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2104	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2105	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2106	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2107	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2108	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2109	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2110	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2111	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2112	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2113	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2114	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2115	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2116	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2117	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2118	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2119	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -
2120	\$ 36,370	\$ 35,657	\$ -	\$ -	\$ -	\$ -