STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

Washington State Energy Code Development

Standard Energy Code Proposal Form

May 2018

Log No. __19-WSEC-R32__
TAG Revision 5/31/19

Code being amended: ☐ Commercial Provisions ☒ Residential Provisions

Code Section # __R401, R408 (new section)_____

Brief Description:

Add passive house certification (PHIUS and PHI) as high-level alternate compliance paths on the same level as the R405 Simulated Performance Alternative, as being sufficient to demonstrate energy code compliance without calculation of a standard reference design. These paths would be bolstered by some additional prescriptive requirements. Verification of the energy design based on plans and specifications would be required for permit, and final certification would be required for certificate of occupancy.

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.)

R401.2 Compliance. Projects shall comply with one of the following:

1. Sections R401 through R404. In addition, *dwelling units* and *sleeping units* in a *residential building* shall comply with Section R406.

2. Section R405. In addition, *dwelling units* and *sleeping units* in a *residential building* shall comply with Section R406.

3. Section R408 (certified passive house).

SECTION R408

CERTIFIED PASSIVE HOUSE

R408.1 General. Projects shall comply with R408.2 or R408.3

R408.2. Passive House Institute US (PHIUS): PHIUS+ 2018 Passive Building Standard, including its USDOE Energy Star and Zero Energy Ready Home co-requisites, and performance calculations by PHIUS-approved software. Projects shall also comply with the provisions of ~~sections R401 through R404 formerly labeled "Mandatory"~~Table R405.2~~, i.e., R401.3 Certificate, R402.2.9.1 Heated slab-on-grade floors, R402.4 Air leakage, R402.5 Maximum fenestration U-factor, R403.1 Controls, R403.1.2 Heat pump supplementary heat, R403.3.2 Sealing, 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 maintenance system, 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, R404.1 and R404.1.1 Lighting equipment~~.

R408.2.1 PHIUS Documentation

1. Prior to the issuance of a building permit, the following items must be provided to the Building Official: A list of compliance features, and a PHIUS Pre-certification letter.

2. Prior to the issuance of a certificate of occupancy, the following item must be provided to the building official: A PHIUS+ 2018 (or later) project certificate.

R408.3. Passive House Institute (PHI): Low Energy Building Standard, version 9f or later, including performance calculations by PHI-approved software. Projects shall also comply with the provisions of Section R401 through R404.

R408.3.1 PHI Documentation

1. Prior to the issuance of a building permit, the following items must be provided to the building official: A list of compliance features, and a statement from a Passive House Certifier that the modeled energy performance is congruent with the plans and specifications, and that the modeled performance meets said standard.

2. Prior to the issuance of a certificate of occupancy, the following item must be provided to the building official: A PHI Low Energy Building project certificate.

Purpose of code change:

Supports progress towards the 70% building energy savings and zero-emission goals mandated by RCW 19.27A.160 and RCW 19.27A.020, by recognizing performance-focused passive-building approaches.

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 1 – 3 stories
- ☐ Multi-family 4 + stories
- ☐ Commercial / Retail
- ☐ Institutional
- ☐ Industrial

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Your organization Shift Zero

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Economic Impact Data Sheet

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

Passive house certifications represent a performance-based approach to energy savings, meaning that a number of different combinations of energy-saving measures are possible design choices – there is some design flexibility, as long as the modeled energy use of the proposed design is below the required levels. In contrast, the usual prescriptive approach may become awkward when reaching for deep energy savings, requiring overinvestment in some measures and underinvestment in others.

The main distinguishing feature of passive building standards is that there are separate performance criteria specifically on heating and cooling energy, as well as overall energy use. This makes for a particular focus on using passive measures to reduce heating and cooling loads, which are still the largest energy end-use for most residential buildings in most climates. In normal operation this tends

to reduce the seasonal and daily fluctuation in the load on the utility and in outage situations it increases the resilience or passive-survivability of the building from a thermal comfort point of view.

For cold climates the "kit" of passive measures that works well together has been known for some decades now – superinsulation including multi-pane glazing and thermally-broken construction details, air-sealing, balanced ventilation with heat recovery, and any combustion appliances sealed. There are still some pitfalls though, and with a performance-standard approach it becomes important that the energy modeling is done correctly/consistently; this requires some training, and there is energy design work to be done on each project. Certification programs bring 3rd party verification of the energy design and model, and key aspects of the construction quality – such as the air-tightness and the moisture/vapor control.

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**)

$7.10/square foot (For residential projects, also provide $9800/ dwelling unit)

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

The initial cost estimates above are taken from a subset of the life-cycle cost optimization study that was done to set the PHIUS+ 2018 heating and cooling criteria (presentation slide deck attached for background). The cost data is from NREL's National Residential Efficiency Measures Database, as implemented in BEopt 2.8. A total of 300 cases were run in the PHIUS study, covering all North American climate zones, five building sizes from 1000-80000 square feet, and three occupant densities from 875 to 235 square feet per person. Fifteen of those cases happened to occur in Oregon, Washington, or British Columbia, and the numbers quoted above are simple averages of those cases.

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) 11 KBTU/ square foot

(For residential projects, also provide 19500 KBTU / dwelling unit)

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

The numbers entered above assume that what is being asked for here is the difference in site energy use (all end-uses) between WA state 2015 code and the proposal, possibly net of on-site renewables but not of off-site renewables. It also assumes that all projects would use the R408 alternate path; this is an exaggeration.

The assumptions about the 2015 WA code performance are taken from Ecotope's spreadsheet "WSEC2018_proposal_estsavings_weighting" with some additional unit conversions shown in the yellow highlight (see excerpt below in Table 1.) This shows that on a per square foot basis, there is not much difference between single-family and multifamily: 29.6±0.7 kBtu/sf.yr. On a per-unit basis the difference is much larger.

The data for the proposal's energy performance is again taken only from the NW subset of the PHIUS+ 2018 study. On a per square foot basis the site EUI averaged 18.6 kBtu/sf.yr from conservation measures alone (passive and equipment, no renewables). Thus the savings = 29.6 – 18.6 = about 11 kBtu/sf.yr.

The per-unit situation appears more uncertain, with the multifamily showing negative savings, 24872 – 27925 = -3053 kBtu/unit.yr and the single family positive savings 63022 – 20914 = 42108 kBtu/unit. Averaging those two gives the 19500 kBtu/unit entered above, but the uncertainty is something like ±100%.

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

Table 1. 2015 WA code EUI benchmarks, by Ecotope.

code	btype	filter_base	Total energy use (kWh equiv)	Savings over 2015	Savings over 2006	heated floor area sf	Total site energy use per unit kBtu/sf	Total site energy use kBtu/sf	PHIUS Net site energy limit kBtu/sf
wa2006	mf	base	10363			820	35358	**43.1**	
wa2006	sf	base	27095			2181	92447	**42.4**	
wa2015	mf	base				820			
wa2015	mf	notbase	7289			820	**24872**	**30.3**	**12.4**
wa2015	sf	base				2181			
wa2015	sf	notbase	18471			2181	**63022**	**28.9**	**12.4**

Table 2. EUI data from NW subset of PHIUS+ 2018 Optimization Study_FINAL – Run list.

Run	Building	Occ nominal	Occ P/sf	Location [1]	Climate Zone	Notional iCFA	WUFI Passive Site Energy (kBTU/ft2.yr)	BEopt site energy kBtu/sf.yr	# units	WUFI Passive Site Energy per unit kBtu/yr	BEopt site energy per unit kBtu/yr	Initial cost premium $/sf	Initial cost premium $/unit
1	SF-duplex small	Lo	0.001003	PORTLAND/HILLSBORO OR	4C	997	16.31	18.75	1	16262	18690	$7.1	$7,095
2	SF-duplex small	Lo	0.001003	HANFORD WA	5B	997	19.56	22.25	1	19502	22180	$13.1	$13,075
60	SF-duplex small	Hi	0.004012	Comox Airp. BC	4	997	33.51	25.56	2	16706	12740	$12.4	$6,191
63	SF-duplex typcl	Lo	0.001109	PORTLAND/HILLSBORO OR	4C	1,803	13.2	9.75	1	23805	17590	$8.2	$14,736
64	SF-duplex typcl	Lo	0.001109	WHITE ROCK, BC	5	1,803	13.37	10.17	1	24111	18340	$10.1	$18,126
97	SF-duplex typcl	Md	0.002773	BURNS MUNICIPAL ARPT [UO] OR	6B	1,803	20.28	14.24	1	36573	25680	$10.7	$19,256
101	SF-duplex typcl	Hi	0.004436	Abbotsford A BC	5	1,803	27.16	17.89	2	24490	16130	$13.2	$11,864
											20914		
153	Townhomes	Md	0.002654	WENATCHEE/PANGBORN WA	5B	15,073	18.67	13.59	8	35177	25614	$4.7	$8,811
211	MF-Midrise	Md	0.002916	EPHRATA AP FCWOS WA	5B	32,920	21.41	21.14	32	22026	21753	$4.1	$4,229
228	MF-Midrise	Hi	0.004374	HANFORD WA	5B	32,920	30.22	29.41	48	20726	20167	$1.2	$827
247	MF-Highrise	Lo	0.000972	Abbotsford A BC	5	82,300	12.89	12.13	40	26521	24964	$4.3	$8,879
251	MF-Highrise	Lo	0.000972	PORTLAND/HILLSBORO OR	4C	82,300	13.45	12.31	40	27673	25327	$3.2	$6,509
256	MF-Highrise	Lo	0.000972	Comox Airp. BC	4	82,300	13.98	13.05	40	28764	26849	$3.5	$7,153
275	MF-Highrise	Md	0.002916	BURNS MUNICIPAL ARPT [UO] OR	6B	82,300	20.07	16.46	40	41294	33863	$6.7	$13,788
283	MF-Highrise	Hi	0.004374	Summerland, BC	6	82,300	27.26	20.91	60	37392	28683	$4.5	$6,201
							18.6			27925		$7.1	$9,783

Also attached are:
An additional draft comparison study of WA code to the earlier PHIUS+ 2015 standard, by TRC solutions.
Three case studies on WA code versus the original PHIUS+ (2012) and PHIUS+ 2015, by PHIUS.

Lastly, note that the PHIUS+ 2018 framework on total impact uses net source energy and credits both on-site and some off-site renewable energy options, including discounted RECs. The equivalent net site energy target (for an all-electric building) would be down around 12.4 depending on occupant density, so the "savings" including renewables would be closer to 17 kBtu/sf.yr, again if everyone used this path.

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

Probably not long, 0.25 – 0.5 hours.

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