STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

Washington State Energy Code Development

Standard Energy Code Proposal Form

Jan 2022

Log No. _____

Code being amended: ☐ Commercial Provisions ☒ Residential Provisions

Code Section # _____R408_____

Brief Description:

Add Built Green certification (3-Star, 4-Star, 5-Star, Emerald Star, Net Zero Energy Label) as high-level alternate compliance paths, as being sufficient to demonstrate energy code compliance without calculation of a standard reference design; or to qualify as compliance with Section 406 when combined with adherence to sections 401-404 or 405. Verification of the energy design based on plans and specifications would be required for permit, and certification of energy performance by Built Green 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.)

[Following code text copied from the 2021 WSEC-R Integrated Draft and its comments]

R401.2 Application. Residential buildings shall comply with Section R401.2.4 and either Sections R401.2.1, R401.2.2, R401.2.3, or R401.2.4.

Exception: Additions, alterations, repairs and changes of occupancy to existing buildings complying with Chapter 5.

R401.2.1 Prescriptive Compliance Option. The Prescriptive Compliance Option requires compliance with Sections R401 through R404.

R401.2.2 Total Building Performance Option. The Total Building Performance Option requires compliance with Section R405.

R401.2.3 Passive House Compliance Option. The Passive House Compliance Option requires compliance with Section R407.

R401.2.4 Built Green Compliance Option. The Built Green Compliance Option requires compliance with Section R408.

R401.2.5 Additional energy efficiency. This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For buildings complying with Section R401.2.1, one of the additional energy efficiency package options shall be installed according to Section R406.
2. For buildings complying with Section R401.2.2, the building shall meet one of the following:
   - 2.1 One of the additional efficiency package options in Section R406 shall be installed without including such measures in the proposed design under Section R405; or
   - 2.2 The proposed design of the building under Section R405 shall have an annual energy consumption based on carbon emission that is less than or equal to XX percent of that of the standard reference design.
3. For buildings complying with Section R401.2.3 [there is currently no requirement for this section to comply with Section R406].

R408 Built Green Compliance Option

R408.1 Built Green. Projects shall comply with Built Green certification (3-Star, 4-Star, 5-Star, Emerald Star, Net Zero Energy Label) including its co-requisites and requirements under the version of the required New Construction Checklists [Single-Family/Townhome, Multifamily, and Emerald Star] by Built Green. To maintain Built Green's standard of certifying above-code buildings it updates the New Construction checklists' energy performance requirements with each new WSEC, the version a project must comply to is determined by the WSEC the project is permitted under. Projects shall also comply with the co-requisite provisions of section R401.2.5 and either R401.2.1 or R401.2.2 by Built Green-approved prescriptive documentation protocols or modeling software.

R408.2.1 Built Green New Construction Checklist Documentation. Prior to the issuance of a building permit, at time of permit application, the following items must be provided to the *code official*:

1. A preliminary Built Green Checklist that lists compliance credits and features for a targeted Star-level certification or Net Zero Energy Label.
2. A statement from a Built Green Verifier that the modeled energy performance is congruent with the plans and specifications, and that the modeled performance meets said certification standard.

Prior to the issuance of a certificate of occupancy, the following items must be provided to the *code official* from the Built Green Verifier:

1. A list of compliance features.
2. Pre-certification statement from Built Green that acknowledges that the modeled energy performance meets the required energy performance for the targeted certification level.

Provide *code official* Built Green certificate within 180 days from the issuance of the final certificate of occupancy.

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 energy efficient and net zero energy 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

Your name Sonja O'Claire

Your organizations Master Builders of King and Snohomish Counties, and BetterBuiltNW

Other contact name Dan Wildenhaus

Email address soclaire@mbaks.com, DWildenhaus@trccompanies.com

Phone number 425-460-8238

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.

Built Green Certifications represent a prescriptive and performance-based approach to holistic building sustainability, meaning that Built Green rates a building not only on energy savings, but also on a variety of building performance factors; including Site and Water conservation, Energy Efficiency, Indoor air Quality, Materials Efficiency, and Equity and Social Justice. Built Green was created in 1999 for the Washington residential market and from the beginning has tied its performance requirements to reach beyond Washington State's building and energy codes, and local market contexts. Its mission is to serve as the driving force for environmentally sound design, construction, and development practices in Washington's cities and communities. By using a combination of prescriptive and performance credits Built Green certification provides flexibility in possible design options to reflect the project's local market and client context. With each WSEC code update Built Green checklists increase its performance requirements to remain ahead of required code minimums.

Built Green's holistic approach offers a larger more inclusive approach to building performance and measuring the positive impacts development of housing can have on a community. As it pertains directly to energy efficiency, Built Green's energy performance pathways, WaterSense fixtures, and Energy Star appliance requirements reduce energy consumption of homes and increase thermal envelope performance this reduces operational carbon emissions and occupant utility bills, while increasing occupant comfort. Buildings certified with Net Zero Energy Label and Emerald Star are required to be fossil fuel free, or 100% electric powered and produce their own power onsite or within ¼ mile, so they significantly reduce the utility bills for owners and are contributing to a carbon-neutral grid.

Built Green also addresses reduction of carbon emissions [operational and embodied] that align with current and projected State policies and energy plans and are creating more extreme heating and cooling requirements for buildings to provide safe indoor environments for occupants. Currently, embodied carbon emissions from construction represent 11% of all carbon emissions from a building's lifecycle. Through Built Green's material efficiency credits, projects can reduce the carbon emissions from the construction of the building. As energy efficiency of buildings increases the upfront embodied carbon becomes a higher percentage of carbon emissions over a building's lifecycle; embodied carbon emissions are anticipated to represent 50% of building emissions by 2050.

Additional non-energy related economic benefits from the certification include:
Addressing indoor air quality improves health of occupants and may reduce medical costs from health incidences related to poor indoor air quality. Higher quality systems and longer-lasting materials reduce the frequency of replacement costs for owners and occupant education ensures systems are maintained to provide high-efficient performance. Requirements to address equity and social justice contributes to economic development opportunities for entering the trades or to increase homeownership. Universal design also allows for people to age-in-place and live in their homes longer, thus reducing moving and relocation costs throughout changes in life stage.

Impacts on local jurisdictions include:
Local code officials will need to be educated on the basics of Built Green certification and its star levels. They may need to create processes and procedures to collect Built Green compliance documentation during the permit application, certificate of occupancy, and project close-out stages. Local jurisdictions can benefit from the 3rd party verified performance and the quantifiable environmental impact metrics that Built Green certification provides to assist with measuring success of achieving emissions reduction goals.

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**)

$3.56/square foot (For residential projects, also provide $7,887.18/ dwelling unit) the range of cost is representative of cost increases as Certification Star level increases to 3-Star.

$4.44/square foot (For residential projects, also provide $9,836.82/ dwelling unit) the range of cost is representative of cost increases as Certification Star level increases to 4-Star.

$6.00/square foot (For residential projects, also provide $13,923/ dwelling unit) the range of cost is representative of cost increases as Certification Star level increases to 5-Star.

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

Report/Source	Delta	Size	Avg Cost	Cost/sqft	
PassiveHaus code proposal	Code to PH	1381	9800	7.1	
Incremental cost for DOE ZERH	Code to DOE ZERH*	3005	18719	6.23	
Average IECC cost effectiveness	2018 to 2021 IECC**	2376	4800	2.02	
CEC 2019 Res New Con CE Report	Code Change	2100	5100	2.43	
				17.78	
Average		2215.5		4.44	Using this for 4-Star
*While builders were only asked to provide costs to get to DOE ZERH minimums, some included all incremental costs for their build, which often extends beyond the DOE ZERH minimum compliance requirements.					
** Averaged cost increase between HIRL, PNNL, and ICF analysis					
3-Star cost	~20% less cost than 4-Star			3.56	
5-Star cost	~35% higher cost than 4-Star			6.0	

Costs were determined by combining:

- PassiveHaus costs from 2018 WSEC-R code proposal
- Incremental Cost to get to DOE ZERH over cost to build to code as prepared by PNNL
- Average cost to go from 2018 IECC to 2021 IECC from multiple reports (Delta in efficiency is ~9.4% according to ICC Cost Impact Guide)
    - Cost Effectiveness of the Residential Provisions of the 2021 IECC as prepared by ICF
    - 2021 IECC Residential Cost Effectiveness Analysis as prepared by Home Innovation Research Labs
    - National Cost Effectiveness of the Residential Provisions of the 2021 IECC as prepared by PNNL
- 2019 California Energy Commission Residential New Construction Cost Effectiveness Report as prepared by Commission staff

The costs collated and averaged were based on programs or code improvements representing ~10% or higher improvements in energy efficiency, as found over the last nine years. PassiveHaus costs were included, despite that program correlating most closely to the 5-Star BuiltGreen level only.

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

1.99 KBTU/ square foot for 3-Star

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

4.50 KBTU/ square foot for 4-Star

6.77 KBTU/ square foot for 5-Star

4.75 KBTU/ square foot all Star levels combined and averaged.

These were all based on single family homes. Results of analysis can be found in the attached Models Tallied for WSEC Proposal.

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

House ID	Location	BG star level	S-M-L	CFA	BRs	Code	Central-Zonal	Energy saved	Energy Use	Electirc	Gas	Fuel Type	%improvement	ERI-2018	ERI- code year	Carbon*	TH-Det	Energy Savings
						WSEC		Mmbtu/yr	Mmbtu/yr	kWh/yr	Therms							Kbtu per sq ft
D-BAN	Seattle	5	M	2121	4	2015	Zonal	18.11	38.35		0	E-E	32.1	62	60	1.6	Det	8.54
KJ-LKSR	Seattle	5	L	9821	8	2015	Central	47.24	92.38	25786	44	E-E	34.9	49	47	4	Det	4.81
MDDB-75	Edmonds	4	M	2987	5	2015	Zonal	16.9	46.92	9354	150	E-G	18.6	58	58	2.2	Det	5.66
GC-P3-H1	Seattle	4	M	1745	3	2018	Zonal	2.97	25.74	7545	0	E-E	10.3	50		1.1	TH	1.70
GC-P3-H2	Seattle	4	S	1165	2	2018	Central	5.43	21.96	6435	0	E-E	19.8	59		0.9	TH	4.66
GC-P3-H1-Sp	Spokane	4	M	1745	3	2018	Zonal	3.56	34.61	10143	0	E-E	9.3	50		1.4	TH	2.04
GC-P3-H2-Sp	Spokane	4	S	1165	2	2018	Central	9.88	29.41	8620	0	E-E	25.2	59		1.2	TH	8.48
MR-Abb-107	Seattle	5	M	1804	2	2015	Zonal	14.57	27.87	8167	0	E-E	34.3	50	48	1.2	Det	8.08
MR-Abb-108	Seattle	5	M	1804	2	2015	Zonal	15.3	27.14	7954	0	E-E	36	48	46	1.1	Det	8.48
AK-64	Seattle	3	M	1819	3	2018	Zonal	2.19	25.08	7350	0	E-E	8	55		1	Det	1.20
TC-ORAv	Bellingham	5	M	2270	4	2018	Zonal	8.96	27.49	8056	0	E-E	24.6	39		1.1	Det	3.95
VH-Brod	Richland	3	M	1905	3	2018	Central	5.22	42.58	12479	0	E-E	10.9	57		1.6	Det	2.74
Intra-6405	Seattle	3	S	1125	2	2018	Zonal	2.29	19.32	5663	0	E-E	10.6	56		0.8	Det	2.04
DC-9026	Seattle	4	S	1236	2	2018	Central	5.54	21.84	6402	0	E-E	20.2	57		0.9	Det	4.48

% Improvement is completed using current User Defined Reference Homes for the 2018 WSEC-R and generating a Fuel Summary Report
All modeled in REM/Rate v16.0.6
*Emmissions report in REM/Rate

TH = Townhome
Det = Detached home

Savings

- Average savings for a modeled all-electric home, at 2450 sq ft would equate to: 8.53 Mmbtu/yr, taking out the largest home and largest savings number. This translates to 2,500 kWh/yr. At EAI rates for WA (10.07 cents/kWh), this translates to $252/yr
    - All electric homes are by far the most common in BuiltGreen and only two models submitted used any natural gas.
- Average savings from the 2016 Built Green Post Occupancy White Paper (reviewing 2014 Built Green homes in Seattle WA) were tabulated by comparing annual energy bills for Built Green vs non-certified homes. Average savings per star level were found to be:
    - 2,900 kWh/yr for 3-Star
    - 3,800 kWh/yr for 4-Star
    - 4,700 kWh/yr for 5-Star
    - Average breakdown of homes from 2014-2016 (estimated from White Paper data)
        - 20% for 3-Star
        - 75% for 4-Star
        - 5% for 5-Star
    - Weighted average savings are then: 3,665 kWh, which would translate to $369/yr
- As codes have advanced, reducing overall energy usage in building and therefore available savings, the modeled energy savings + 10% are being used for this calculation as the Post Occupancy White Paper has shown that homes typically save well beyond 10% above modeled savings.
- **$277.20/yr**

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

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By developing a simplified report based on Preliminary Checklists, as well as a verified final Built Green certification submission from the Verifier, assessing Built Green compliance should be similar or equal to any performance based (section R405), Passive House process (R407), or future ERI adoption.

Small Business Impact. Describe economic impacts to small businesses:

Built Green, as a program of the Master Builders Association of King and Snohomish Counties, serves residential builders of all sizes, but primarily small-to-medium sized businesses. Along with the benefits of using locally sourced materials [made or sourced within a 500 mile of the project site] to reduce carbon emissions from construction, Built Green offers points in its checklists to projects that use local suppliers, vendors, and manufacturers. This focus on local businesses includes many small businesses. Through our association and network of builders, suppliers, vendors and manufacturers, small businesses can leverage and market the points their businesses and products can offer builders towards their Built Green certification to grow their businesses.

Housing Affordability. Describe economic impacts on housing affordability:

Housing affordability is comprised of both first and operational costs to operate the home, as well as insurance and maintenance. The savings analysis (summarized above and included as an attachment) show operational energy savings. In 2015, Built Green in partnership with Seattle City Light, looked at homes certified in 2014 in a post occupancy study, finding 4-Star and higher certified homes saved at least 33% over uncertified homes built during that same time (see attached study), while only projecting to save 15+%.

Built Green homes also produce water savings, which have not been fully quantified, but the WaterSense program estimates savings of 30,000 to 70,000 gallons a year. For analysis, a conservative number of 20,000 gallons saved has been used.

To this, many home insurance companies provide discounts for certified homes as they tend to have fewer building defects as built in, due to on site verification and program requirements. In total, housing affordability can be a net positive to homeowners:

Additional construction costs average: $ 9,836.82 for 4-Star Certification, or **$10,829** average cost between all star levels.
Annual savings for energy: **$277.20**
Annual savings for water: Average used per person in WA (EPA.gov/WaterSense/how-we-use-water) = 101.5 gallons. For a home of 2.5 people = 254/day. Annual use = 82,710. With WaterSense or equivalent certification = 63,000. This equates to a waters savings of ~25% on an average monthly water bill of $43.63, or $9.07/month. This equates to **$108.84/year.**

Using the IECC-R approved LCC Calculator the cost effectiveness can be seen as:

Cost Effectiveness
As indicated in the LCC as seen above and using energy savings as described above, the LCC shows Simple Payback at around 22-26 years, with reasonable Measure incremental LCC for 3% real, OMB discount rates. In CZs 2 and 3, the measure is not by itself cost effective.

CZ/Metric	Net Cost	Measure Savings	Discount 3% Real w/SCC	Discount 3% Real w/o SCC	Simple Payback w/ SCC	Simple Payback w/o SCC
4 and 5	**$10,829**	**3665 kWh/yr**	**$4,892.56**	**$3,069.82**	**15.80 yrs**	**17.70 yrs**

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LCC Calculator - IECC Residential

Enter values into blue boxes

Proposal information

Proposal number	BuiltGreen section 408	
CDP ID#		
Proponent	Wildenhaus, Dan	
Climate zone(s) analyzed	4c, 5b	Enter specific climate zone or zones included in the analysis below
Additional Notes	3 star, 4 star, 5 star averaged	

Methodology

Description of measure cost methodology	Combined costs from builder interviews, IECC cost effectiveness analysis, CEC 2019 Res New Con CE Report, PassiveHouse 2019 WSEC-R Proposal.	
Description of savings calculation methodology. Include information about climate zones and fuel types where appropriate.	Combined and averaged reported savings estimates from previous analysis along with energy modeling in REM/Rate v16.0.6.	

Inputs

Net measure cost	10829	2020$, measure cost to consumer, including markup, less tax credits or other incentives
Measure electric savings	3665	kWh/year
Measure natural gas savings		therms/year
Measure propane savings		gallons/year
If applicable:		
Change in maintenance or other non-energy operating costs	-108.8	2020$/year (+ for increased cost, - for decreased cost)
Replacement cost		2020$
Year of first replacement		For measures with life <30 years, # of years from date of construction
Year of second replacement		For measures with life <30 years, # of years from date of construction

Results

	Discount Rate				
	3% nominal	3% real	7% real		
	DOE	OMB	OMB		
With SCC value					
Measure incremental LCC	$6,866.82	$4,892.56	$3,027.48		2020$ (+ for savings, - for increased cost)
Simple payback				15.80	Years
With SCC = $0					
Measure incremental LCC	$5,044.08	$3,069.82	$1,204.73		2020$ (+ for savings, - for increased cost)
Simple payback				17.70	Years

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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:

The Pearl Certification program performed an appraiser's analysis of certified homes in 2017, finding that certified homes had a 2 – 5% home sale premium when compared to uncertified homes. The 5% is found in markets where certification brand is well recognized and 2% was found in markets without brand recognition. The Pearl Certification report is part of the supplementary package. This report aligns with a white paper developed for Freddie Mac loans. This paper is also included in the supplementary package.

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