STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

1. State Building Code to be Amended:

- ☒ International Building Code
- ☐ ICC ANSI A117.1 Accessibility Code
- ☐ International Existing Building Code
- ☐ International Residential Code
- ☐ International Fire Code
- ☐ Uniform Plumbing Code
- ☐ International Mechanical Code
- ☐ International Fuel Gas Code
- ☐ NFPA 54 National Fuel Gas Code
- ☐ NFPA 58 Liquefied Petroleum Gas Code
- ☐ Wildland Urban Interface Code

For the Washington State Energy Code, please see specialized energy code forms

Section(s): New Appendix Q

Title: Embodied Greenhouse Gas Emissions Reporting and Reduction

2. Proponent Name (Specific local government, organization or individual):

Proponent: New Buildings Institute
Title: Non-profit organization
Date: September 19, 2024, updated November 15, 2024, updated November 26, 2024

3. Designated Contact Person:

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4. Proposed Code Amendment:

Code(s): Washington State Building Code **Section(s)**: New Appendix Q

Add new Appendix as follows:

Appendix Q Embodied Greenhouse Gas Emissions Reporting and Reduction

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User note:

About this appendix: *The purpose of Appendix Q is to establish methods to measure and reduce the embodied carbon impact of building materials over the course of a building's life. Appendix Q provides criteria for the production and submission of environmental product declarations, whole building life cycle assessment, and proof of building reuse for a building project.*

Section Q101
General

Q101.1 Scope. The provisions of this appendix promote methods to measure and to reduce the environmental impact of building materials over the course of a building's life.

Section Q102
Definitions

Section Q102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

Covered project. A new building or structure, or an addition to an existing building or structure, **[INSERT 50,000 OR 100,000]** gross square feet or larger; or an *alteration* that impacts a *work area* of **[INSERT 50,000 OR 100,000]** gross square feet or larger.

Embodied carbon. The sum of greenhouse gas emissions associated with extraction, production, transport, and manufacturing of a product through the product's life.

Environmental product declaration (EPD). A third-party verified report providing information about the environmental performance or impact of a covered product or material.

Global warming potential (GWP). The metric for tracking *embodied carbon*, which is reported in kg CO_2e/unit. GWP normalizes different gases associated with a product to an equivalent mass of carbon dioxide over a period of 100 years.

~~**Industry-average EPD.** An *EPD* that reports the impacts of a product, which is an average of data provided by multiple manufacturers in a clearly defined sector and/or geographical area.~~

Product and facility-specific EPD. An *EPD* that represents the impacts of a single product from a single manufacturing facility.

Work area. That portion or portions of a building consisting of all reconfigured spaces as indicated on the construction documents. *Work area* excludes other portions of the building where incidental work entailed by the intended work must be performed and portions of the building where work not initially intended by the owner is specifically required by this code.

Section Q103
Embodied Carbon ~~nvironmental product declaration (EPD)~~.

Q103.1 Embodied Carbon. *Covered projects* shall document *embodied carbon* on *construction documents,* which shall be submitted to the *building official*.

Q103.2 Documentation of Embodied Carbon. Documentation of *embodied carbon* for *covered projects* shall meet one of the following pathways:

1. Product compliance or whole building compliance pathway; for a new building or structure, or an *addition* to an existing building or structure, **[INSERT 50,000 OR 100,000]** gross square feet or larger.

2. Building reuse compliance pathway; for an *alteration* that impacts a *work area* of **[INSERT 50,000 OR 100,000]** gross square feet or larger.

3. Product compliance, whole building compliance, or building reuse compliance pathway; for an *addition* to a building or structure that also includes an *alteration*, where the *addition* and *work area* of the *alteration* have a combined area of **[INSERT 50,000 OR 100,000]** gross square feet or larger.

Q103.3 Product compliance pathway. *Covered projects* shall submit Type III *environmental product declarations*, which cover the cradle-to-gate phase or life cycle modules A1 through A3, for all covered products per section Q103.3.1. The product compliance pathway shall calculate the *global warming potential (GWP)* of the total mass or volume of the covered products and total no more than **[INSERT 85, 90, 100, or 120]** percent of the sum of the applicable *GWP* values from Table Q103.3.1, for the same total mass or volume of the covered products.
The calculation shall include the following:

1. Project-specific product quantities and *product-specific EPDs,*
2. Be summed across the entire project based on mass or volume, and
3. Be submitted on a product pathway compliance form (see example in this appendix).

~~A *product-specific EPD* is permitted to combine varying levels of manufacturing specificity and may be covered across multiple facility locations. Where a *product-specific EPD* is not available for a building product, an *industry-average EPD* shall be permitted.~~

Q103.3.1 Covered products. Covered products shall include no less than 90 percent of the total combined mass or volume of all product(s) used in the building project that are included in Table Q103.3.1.

~~(a) Structural concrete products, including ready mix, shotcrete, precast, and concrete masonry units.~~
~~(b) Reinforcing steel products, specifically rebar and posttensioning tendons.~~
~~(c) Structural steel products, specifically hot rolled sections, hollow sections, metal deck, and plate; and~~
~~(d)Engineered wood products, such as cross-laminated timber, glulam beams, laminated veneer lumber, parallel strand lumber, dowel laminated timber, nail laminated timber, glulam laminated timber, prefabricated wood joists, wood structural panel, solid sawn lumber, structural composite lumber, and structural sawn lumber.~~

TABLE Q103.3.1

COVERED PRODUCT GWP VALUES[a]

COVERED PRODUCT		GLOBAL WARMING POTENTIAL	UNIT OF MEASUREMENT
Ready mix concrete products[1]	Up to 2,500 psi	235	kg CO_2e/m^3
	3,000 psi	261	kg CO_2e/m^3
	3,500 psi	289	kg CO_2e/m^3
	4,000 psi	316	kg CO_2e/m^3
	4,500 psi	351	kg CO_2e/m^3
	5,000 psi	386	kg CO_2e/m^3
	5,500 psi	397	kg CO_2e/m^3
	6,000 psi	408	kg CO_2e/m^3
	8,000 psi and greater	487	kg CO_2e/m^3
	Lightweight, up to 3,000 psi	518	kg CO_2e/m^3
	Lightweight 3,500 psi	547	kg CO_2e/m^3
	Lightweight, 4,000 psi	575	kg CO_2e/m^3
	Lightweight 4,500 psi	604	kg CO_2e/m^3
	Lightweight, 5,000 psi and greater	632	kg CO_2e/m^3
Concrete masonry unit products[1]	Normal-weight, f'm ≤ 2000 psi	208	kg CO_2e/m^3
	Normal-weight, f'm = 2500 psi	232	kg CO_2e/m^3
	Normal-weight, f'm ≥ 3000 psi	241	kg CO_2e/m^3
	Medium-weight, containing manufactured lightweight aggregate,[2] f'm ≤ 2000 psi	360	kg CO_2e/m^3
	Medium-weight, containing natural aggregate and industrial byproducts,[3] f'm ≤ 2500 psi	244	kg CO_2e/m^3
	Lightweight, containing manufactured lightweight aggregate, f'm ≤ 2500 psi	395	kg CO_2e/m^3
	Lightweight, containing natural aggregate and industrial byproducts, f'm ≤ 2000 psi	286	kg CO_2e/m^3
	Rebar – unfabricated	753	kg CO_2e/metric ton

[1] For products that fall in-between a strength designation (PSI), round to the nearest applicable product.

[2] Examples of manufactured lightweight aggregate are expanded shale, clay, and slate.

[3] Examples of natural aggregates are pumice, scoria, and limestone. Examples of industrial byproducts are expanded slag and bottom ash.

Reinforcing steel products	Rebar – fabricated	854	kg CO_2e/metric ton
Structural steel products	Hot-rolled sections – unfabricated	1,000	kg CO_2e/metric ton
	Hot-rolled sections – fabricated	1,220	kg CO_2e/metric ton
	Hollow structural sections – unfabricated	1,710	kg CO_2e/metric ton
	Hollow structural sections – fabricated	1,990	kg CO_2e/metric ton
	Decking	2,320	kg CO_2e/metric ton
	Plate – unfabricated	1,480	kg CO_2e/metric ton
	Plate – fabricated	1,730	kg CO_2e/metric ton
Cold-Formed Steel Framing Products	Hot-dipped galvanized cold-formed steel members	2440	kg CO_2e/metric ton
Open Web Steel Joist and Joist Girders	Open web steel joists and joist girders	1430	kg CO_2e/metric ton
Structural wood products	Laminated veneer lumber	361	kg CO_2e/m^3
	Laminated strand lumber	275	kg CO_2e/m^3
	Glue laminated timber	137	kg CO_2e/m^3
	Wood framing – US Southern	90.39	kg CO_2e/m^3
	Wood framing – US Pacific Coast	73.81	kg CO_2e/m^3
	Wood framing – US Inland Northwest	71.35	kg CO_2e/m^3
	Softwood plywood	219	kg CO_2e/m^3
	Oriented Strand Board (OSB)	242	kg CO_2e/m^3
Insulation products[1]	Expanded polystyrene (EPS) - Type I[4]	2.53	kg CO_2e/ m^2 @ RSI-1
	Polyiso - wall[5]	4.10	kg CO_2e/ m^2 @ RSI-1
	Polyiso – roof – GRF facer	2.11	kg CO_2e/ m^2 @ RSI-1
	Polyiso – roof – CFG facer	2.95	kg CO_2e/ m^2 @ RSI-1
	Extruded polystyrene (XPS)[6] ≤ 25 psi	8.8	kg CO_2e/ m^2 @ RSI-1

[4] There are multiple types of EPS insulation. The industry-average EPD provides methods to calculate the impacts for types other than Type I.

[5] CLF updated the three polyiso values to be only A1-A3. (The previous values also included C4.)

[6] Notes on XPS: A) The US EPA's HFC ban in effect as of January 1, 2025 (https://www.epa.gov/climate-hfcs-reduction/technology-transitions-hfc-restrictions-sector) affects the pool of XPS products, and represents a

	Extruded polystyrene (XPS) 40 psi	10.9	kg CO_2e/ m^2 @ RSI-1
	Extruded polystyrene (XPS) 60 psi	14.1	kg CO_2e/ m^2 @ RSI-1
	Extruded polystyrene (XPS) 100 psi	20.1	kg CO_2e/ m^2 @ RSI-1
	Fiberglass board	5.02	kg CO_2e/ m^2 @ RSI-1
	Heavy density mineral wool board	6.82	1 m^2 @ RSI-1
	Mineral wool blanket (Light-density mineral wool board)	2.68	kg CO_2e/ m^2 @ RSI-1
	Fiberglass blanket (Fiberglass batt) — unfaced	1.01	kg CO_2e/ m^2 @ RSI-1
	Fiberglass blanket (Fiberglass batt) — faced	1.06	kg CO_2e/ m^2 @ RSI-1
	Closed-cell spray polyurethane foam – medium density[7]	2.36	1 m^2 @ RSI-1
	Closed-cell spray polyurethane foam - roofing	3.45	1 m^2 @ RSI-1
	Open-cell spray polyurethane foam	1.05	1 m^2 @ RSI-1
	Loose-fill cellulose	0.487	1 m^2 @ RSI-1
	Loose-fill fiberglass	0.988	1 m^2 @ RSI-1
	Loose-fill mineral wool	1.89	1 m^2 @ RSI-1
	Flat glass (clear, tinted, and low-iron products)	1,430	1 metric ton
Flat Glass	Flat glass (clear, tinted, and low-iron products)	1,430	1 1 metric ton
a.			

major change from past XPS data. The XPS values here represent only products using the new generation of reduced-GWP blowing agent blends. B) Like concrete products, XPS products come in a range of compressive strengths, and this attribute affects both function/application and GWP. Therefore, the provided XPS values are distinguished by compressive strength. C) There is no XPS industry-average EPD. Each of the four major North American XPS manufacturers have published EPDs. However, only one of them provides separate results for each of the listed strengths. (One provides separate results for three strengths, but excludes B1 result values. [See * note at end of table.] The other two provide only a single value for all XPS.) Therefore the listed values are based on a single manufacturer's reported results.

[7] Values provided for closed-cell spray foam are for HFO-based products only given the US EPA's national HFC ban for spray foams coming into effect January 1, 2025. (See https://www.epa.gov/climate-hfcs-reduction/technology-transitions-hfc-restrictions-sector.) (Previous spray foam values were an average of results from HFC- and HFO- based products.)

Q103.4 Whole building compliance pathway. *Covered projects* shall submit a whole building life cycle assessment, developed in accordance with section Q103.4.1, and comply with one of the following:

1. **Absolute reduction requirement.** The *global warming potential* of the proposed building shall be no more than 90 percent of 102 lbCO_2e/square feet (500 kgCO_2e/m^2).

2. **Relative reduction requirement.** The *global warming potential (GWP)* of the proposed building shall be no more than 90 percent of the *GWP* of a functionally equivalent reference building. The reference building shall be of the same size, geographic location, and thermal performance as the proposed building, and shall be functionally equivalent per ASTM E2921-22. The products and product quantities in the proposed building and the reference building are permitted to vary. The same LCA tool(s) or software shall be used to complete the whole building life cycle assessment for both the reference and proposed building designs.

   Q103.4.1 Whole building life cycle assessment. Whole building life cycle assessments shall comply with the following:

   1. ISO 14040 and ISO 14044.

   2. Software used to conduct a whole building life cycle assessment shall conform to ISO 21931—1 and/or EN 15978 and shall have a data set compliant with ISO 14044 and ISO 21930 and/or EN 15804. The software shall utilize calculation methodology that is compliant with EN 15978, ISO 21931—1 and ISO 21929—1. Environmental impact data shall not be sourced from expired or retired data sources.

   3. The scope shall cover cradle-to-grave, including all modules in life cycle stages A, B, and C. The scope is permitted to exclude modules B6 and B7, covering operating energy and water stages.

   4. The assessment shall include all of the following building elements: foundations; *exterior wall envelope; primary structural frame; secondary structural members; roof covering; roof deck; fenestration; load-bearing walls;* and insulation. The assessment is permitted to include *non-load-bearing walls;* fireproofing; interior constructions and *interior finishes.* An assessment submitted for an *addition* or *alteration* is permitted to exclude existing and/or remaining building components.

   5. The reference study period shall be 60 years.

   6. Reuse and salvage. Existing and salvaged building components shall be included or excluded at the discretion of the project team. For reused materials, it is permissible to assume the A1-A4 stages carry no impact in the Proposed Design WBLCA to show the benefit of reusing materials, while retaining the A1-A4 estimated impacts for these products for these materials in the Baseline Design WBLCA. For salvaged materials, it is permissible to assume the A1-A3 stages carry no impact in the Proposed Design WBLCA to show the benefit of reusing materials, while retaining the A1-A3 estimated impacts for these products for these materials in the Baseline Design WBLCA.

   7. Biogenic carbon. Biogenic carbon and carbon sequestration shall be reported separately from fossil GWP

Q103.5 Building reuse compliance pathway. An *alteration* shall retain no less than a combined 45 percent, as calculated per section Q103.5.1, of the *existing building's primary* and *secondary structural frame* and *exterior wall envelope* as part of the *work area.* An *addition* to a building or structure that also includes an *alteration*, where the

addition and *work area* of the *alteration* have a combined area of **[INSERT 50,000 OR 100,000]** gross square feet or larger, is permitted to use this compliance pathway.

Q103.5.1 Building reuse compliance calculation. The calculation shall include roof and floor areas, and façade area as measured in elevation, for the entire building. Façade areas are permitted to be considered retained even if the existing *exterior wall covering* is repaired, replaced, or modified to increase insulation or airtightness.

Exception: Buildings, or portions of building, that are deemed unsafe or *dangerous*, or that have *hazardous materials,* that are remediated as part of the project.

Q103.5.2 Construction documents for building reuse compliance pathway. *Construction documents* for the building reuse compliance pathway shall clearly distinguish the square footage for existing and new elements, and include the following information:

(a) Gross floor area of *existing building*(s) in square feet;
(b) Gross floor area of the aggregate addition(s) in square feet (if applicable);
(c) Gross floor area of the *alteration* in square feet;
(d) Existing total floor area and retained total floor area of the *primary* and *secondary structural frame* of the *existing building*(s) in square feet; and
(e) Existing total *exterior wall* and *fenestration* surface area and total retained *exterior wall* and *fenestration* surface area of the *existing building*(s) in square feet, as well as areas allowed to be excluded from the calculations.

Section Q104
Verification and amended documentation of reduction of embodied carbon

Q104.1 Registered design professional. A *Registered Design Professional* shall prepare the *construction documents* and provide signature verifying compliance with the requirements of this appendix.

Q104.2 Amended construction documents for embodied carbon. Covered products shall be installed in accordance with the approved *construction documents*. Where any change in products occur that are not in compliance with the approved *construction documents,* amended *construction documents,* based on data from procured products, shall be resubmitted for approval prior to the issuance of a certificate of occupancy.

Q105
Referenced Standards

Q105.1 General. See Table Q105.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE Q105.1 REFERENCED STANDARDS

Standard Acronym	Standard Name	Sections Herein Referenced
ASTM E2921—2022	*Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes, Standards, and Rating Systems*	Q103.4.1.2.1
EN 15804—2022	*Sustainability of construction works – Environmental product declarations – Core rules for the*	Q103.4.3

	product category of construction products	
EN 15978—2011	*Sustainability of construction works – Assessment of environmental performance of buildings – Calculation method*	Q103.4.3
ISO 14040—2006	*Environmental management – Life cycle assessment – Principles and framework*	Q103.4, Q103.4.1
ISO 14044—2006	*Environmental management – Life cycle assessment – Requirements and guidelines*	Q103.4, Q103.4.1, Q103.4.2
ISO 21929-1—2011	*Sustainability in building construction – Sustainability indicators – Part 1: Framework for the development of indicators and a core set of indicators for buildings*	Q103.4.3
ISO 21930—2017	*Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services*	Q103.4.3
ISO 21931-1—2022	*Sustainability in buildings and civil engineering works – Framework for methods of assessment of environmental, social and economic performance of construction works as a basis for sustainability assessment – Part 1: Buildings*	Q103.4.3

Sample Product Compliance Pathway Form (project budget approach)

COVERED PRODUCTS		PRODUCT QUANTITIES		GWP REFERENCE VALUES			PROJECT GWP		% CHANGE
column labels...		A	B	C	D	E	F	G	H
Covered Product		Project-specific quantity	Project-specific quantity units	Global Warming Potential (GWP) reference value	GWP reference value units	Reference GWP total per product. (= column A * C)	GWP value per product and facility specific EPD	Actual GWP per product. (= column A * F)	Difference between reference and actual product (%). [= -((E-G/E) *100]
Ready mix concrete products	Up to 2,500 psi	250	m3	235	kg CO2e/m3				
	3,000 psi		m3	261	kg CO2e/m3				
	3,500 psi		m3	289	kg CO2e/m3				
	4,000 psi		m3	316	kg CO2e/m3				
	4,500 psi		m3	351	kg CO2e/m3				
	5,000 psi[1]		m3	386	kg CO2e/m3				
	5,500 psi		m3	397	kg CO2e/m3				
	6,000 psi		m3	408	kg CO2e/m3				
	8,000 psi and greater		m3	487	kg CO2e/m3				
	Lightweight, up to 3,000 psi		m3	518	kg CO2e/m3				

	Lightweight 3,500 psi		m3	547	kg CO2e/m3				
	Lightweight, 4,000 psi		m3	575	kg CO2e/m3				
	Lightweight 4,500 psi		m3	604	kg CO2e/m3				
	Lightweight, 5,000 psi and greater		m3	632	kg CO2e/m3				
Concrete masonry unit products	Normal-weight, f'm ≤ 2000 psi		m3	208	kg CO2e/m3				
	Normal-weight, f'm = 2500 psi		m3	232	kg CO2e/m3				
	Normal-weight, f'm ≥ 3000 psi		m3	241	kg CO2e/m3				
	Medium-weight, containing manufactured lightweight aggregate ,[1] f'm ≤ 2000 psi		m3	360	kg CO2e/m3				

	Medium-weight, containing natural aggregate and industrial byproducts,[2] f'm ≤ 2500 psi		**m3**	**244**	**kg CO2e/m3**				
	Lightweight, containing manufactured lightweight aggregate, f'm ≤ 2500 psi		**m3**	**395**	**kg CO2e/m3**				
	Lightweight, containing natural aggregate and industrial byproducts, f'm ≤ 2000 psi		**m3**	**286**	**kg CO2e/m3**				
Reinforcing steel products	**Rebar – unfabricated**		**metric ton**	**753**	**kg CO2e/metric ton**				
	Rebar – fabricated		**metric ton**	**854**	**kg CO2e/metric ton**				
Structural steel products	**Hot-rolled sections –**		**metric ton**	**1,000**	**kg CO2e/metric ton**				

	unfabricated								
	Hot-rolled sections – fabricated		**metric ton**	**1,220**	**kg CO2e/metric ton**				
	Hollow structural sections – unfabricated		**metric ton**	**1,710**	**kg CO2e/metric ton**				
	Hollow structural sections – fabricated		**metric ton**	**1,990**	**kg CO2e/metric ton**				
	Decking		**metric ton**	**2,320**	**kg CO2e/metric ton**				
	Plate – unfabricated		**metric ton**	**1,480**	**kg CO2e/metric ton**				
	Plate – fabricated		**metric ton**	**1,730**	**kg CO2e/metric ton**				
Cold-Formed Steel Framing Products	**Hot-dipped galvanized cold-formed steel members**		**metric ton**	**2440**	**kg CO2e/metric ton**				
Open Web Steel Joist and Joist Girders	**Open web steel joists and joist girders**		**metric ton**	**1430**	**kg CO2e/metric ton**				

Structural wood products	**Laminated veneer lumber**		**m3**	**361**	**kg CO2e/m3**				
	Laminated strand lumber		**m3**	**275**	**kg CO2e/m3**				
	Glue laminated timber		**m3**	**137**	**kg CO2e/m3**				
	Wood framing – US Southern		**m3**	**90.39**	**kg CO2e/m3**				
	Wood framing – US Pacific Coast		**m3**	**73.81**	**kg CO2e/m3**				
	Wood framing – US Inland Northwest		**m3**	**71.35**	**kg CO2e/m3**				
	Softwood plywood		**m3**	**219**	**kg CO2e/m3**				
	Oriented Strand Board (OSB)		**m3**	**242**	**kg CO2e/m3**				
Insulation products	**Expanded polystyrene (EPS) - Type I[3]**		**m2 @ RS-1**	**2.53**	**kg CO2e/ m2 @ RSI-1**				
	Polyiso - wall[4]		**m2 @ RS-1**	**4.1**	**kg CO2e/ m2 @ RSI-1**				

	Polyiso – roof – GRF facer		**m2 @ RS-1**	**2.11**	**kg CO2e/ m2 @ RSI-1**				
	Polyiso – roof – CFG facer		**m2 @ RS-1**	**2.95**	**kg CO2e/ m2 @ RSI-1**				
	Extruded polystyrene (XPS)[5] ≤ 25 psi		**m2 @ RS-1**	**8.8**	**kg CO2e/ m2 @ RSI-1**				
	Extruded polystyrene (XPS) 40 psi		**m2 @ RS-1**	**10.9**	**kg CO2e/ m2 @ RSI-1**				
	Extruded polystyrene (XPS) 60 psi		**m2 @ RS-1**	**14.1**	**kg CO2e/ m2 @ RSI-1**				
	Extruded polystyrene (XPS) 100 psi		**m2 @ RS-1**	**20.1**	**kg CO2e/ m2 @ RSI-1**				
	Fiberglass board		**m2 @ RS-1**	**5.02**	**kg CO2e/ m2 @ RSI-1**				
	Heavy density mineral wool board		**m2 @ RS-1**	**6.82**	**kgCO2e/m2 @ RS-1**				
	Mineral wool blanket (Light-density mineral		**m2 @ RS-1**	**2.68**	**kg CO2e/ m2 @ RSI-1**				

	wool board)								
	Fiberglass blanket (Fiberglass batt) — unfaced		**m2 @ RS-1**	**1.01**	**kg CO2e/ m2 @ RSI-1**				
	Fiberglass blanket (Fiberglass batt) — faced		**m2 @ RS-1**	**1.06**	**kg CO2e/ m2 @ RSI-1**				
	Closed-cell spray polyurethane foam – medium density[6]		**m2 @ RS-1**	**2.36**	**[2] 1 m2 @ RSI-1**				
	Closed-cell spray polyurethane foam - roofing		**m2 @ RS-1**	**3.45**	**[3] 1 m2 @ RSI-1**				
	Open-cell spray polyurethane foam		**m2 @ RS-1**	**1.05**	**1 m2 @ RSI-1**				
	Loose-fill cellulose		**m2 @ RS-1**	**0.487**	**1 m2 @ RSI-1**				
	Loose-fill fiberglass		**m2 @ RS-1**	**0.988**	**1 m2 @ RSI-1**				
	Loose-fill mineral wool		**m2 @ RS-1**	**1.89**	**1 m2 @ RSI-1**				

Flat Glass	**Flat glass (clear, tinted, and low-iron products)**		**metric ton**	**1.430**	**1 metric ton**				
					TOTAL				

5. Briefly explain your proposed amendment, including the purpose, benefits and problems addressed.

Summary of Requirements and Purpose

This proposal adds a new appendix that, when adopted by a jurisdiction, would require reporting on the embodied carbon emissions associated with proposed projects over 50,000 or 100,000 square feet. Project teams adhering to this appendix must choose one form of reporting from the following three options:

(1) submit proof of reuse of at least 45% of an existing building's structure and enclosure;
(2) submit product-specific environmental product declarations (EPDs) for covered products that meet a certain percentage (as determined by the adopting jurisdiction) of the industry average, reported in global warming potential (GWP).
(3) submit a whole building life cycle assessment (WBLCA) for the building that indicates a 10% reduction in global warming potential (GWP) compared to industry average.

This code change proposal would support Washington's goal to reduce its greenhouse gas (GHG) emissions by 95% by 2050. In its 2021 State Energy Strategy, the Washington State Department of Commerce identified the reduction of embodied carbon in the built environment as a key strategy for reaching the state's 2050 goal. The state's recent House Bill (HB) 1282 took a major step toward addressing this need by establishing a buy clean and buy fair policy that requires reporting on the embodied carbon of concrete, steel, and wood used in projects over 100,000 square feet beginning in 2025.

This proposal builds on the strong foundation and clear direction that Washington state has set for reducing the embodied carbon associated with building materials. The state's buy clean strategies – intended to increase demand for low embodied carbon products, spur EPD development, and build market awareness of GWP reporting methods – are, however, incomplete without these building code provisions. A code-based approach has the unique ability to directly influence the design and construction practices demonstrated by building projects across the state.

Problem and Opportunity

Building operations and building construction are responsible for 39% of today's annual global greenhouse gas (GHG) emissions.[1] About 11% of these emissions are embodied carbon emissions – the emissions associated with the creation of building materials and construction activities. The largest contributors tend to be found in buildings' structures and envelopes, which typically include materials such as concrete, steel, and wood.

The need to confront and reduce embodied carbon is urgent. The IPCC reports that limiting warming to the target set by the Paris Agreement – and avoiding the worst-case impacts of the climate crisis – is contingent on GHG emissions peaking by 2025 at the latest and reducing them by 43% by 2030.

Historically, policies that have targeted the reduction of the built environment's climate impact have focused on the operations associated with buildings' uses: the amount of pollution generated by fuel consumption from mechanical systems used to heat, cool, or light a building. While this focus has been critical, it has not accounted for the full scope of buildings' climate impacts. Additionally, as clean energy policy and efficiency standards and practices ratchet down operational carbon emissions, embodied carbon will continue to become a larger share of buildings' carbon footprint.

Doing justice to the urgency presented by climate change requires a focus on the embodied emissions associated with the early phases of buildings' construction and materials. Unlike operational emissions, which can be improved over the lifespan of a building through deep-energy retrofits and decarbonizing the electric grid, embodied carbon emissions occur before a building is occupied and cannot be reduced over time. A joint University of Washington and University of California, Berkeley study found that, on average, 80% of a building's embodied carbon impacts over its lifetime takes place in the phases leading up to a building's completion before occupancy. Therefore, addressing embodied carbon in the construction of buildings presents an urgent and valuable opportunity to reduce carbon emissions in Washington. Code-based policies thus hold critical potential to address this bulk of emissions, as they impact decisions made early during the design process, which directly and most substantially influence early production and construction activities. Prioritizing these immediate emissions will help to stop the accumulation of GHGs in the atmosphere, improving the likelihood that the world – and Washington – will reach their GHG peaks sooner.

Finally, this code proposal holds the potential to safeguard the public from the hazards associated with the creation of building materials. The International Building Code (IBC) has been in place and used by the design and construction industry to ensure that materials in the built environment preserve public health, safety and welfare. This proposal looks to expand the impact of the IBC to further safeguard the public from the hazards associated with the creation of building materials. This entails reducing emissions in the extraction, manufacturing, and transportation of these products, which can improve air quality and public health in communities located near industrial centers and manufacturing facilities.

Methodology and Reasoning

The materials and building elements that fall within the scope of this proposal were chosen because they are accountable for significant GHG emissions throughout their production phases – at the building level, this means the structure and enclosure; at the material level, this means concrete, steel, and wood.

Three compliance pathways were included to provide project teams the flexibility to choose an option that is most suitable and accessible for its unique circumstances. These pathways are also based in precedent, drawing from California's statewide building code, CALGreen, the latest version of which is now in effect.

Pathway Option 1: Building reuse is incentivized by exempting reuse projects from the reduction and reporting requirements of the other pathways. The aim of including this pathway is to amplify the significant role that building reuse can play in lowering the state's embodied carbon associated with its construction activities. A 2011 study by Preservation Green Lab, Skanska, Green Building Services, and others found that reuse of a variety of building types could realize between 4 and 46 percent embodied carbon savings compared to new construction operating at an equivalent energy performance level.[8] Moreover, it can take between 10 and 80 years for new buildings designed with energy efficiency features to overcome the environmental impacts associated with the construction process. Scaling the practice of reuse across a state's building stock can realize significant reductions.

Pathway Options 2 and 3: The reduction requirements proposed for the next two pathways are also based in precedent and widely regarded as an easily achievable value for most projects. This requirement would

[8] Patrice Frey, Liz Dunn, and Ric Cochran, "The Greenest Building: Quantifying the Environmental Value of Building Reuse" (National Trust for Historic Preservation Green Lab, 2022), https://living-future.org/wp-content/uploads/2022/05/The_Greenest_Building.pdf.

encourage the highest-emitting designs, materials and manufacturers to reduce the carbon content of their systems and materials to be more competitive in the market.

Pathway Option 2: The second pathway option in the proposal takes a materials-based approach, requiring EPD submission and reporting of GWP across 90% of covered materials compared to industry average values. The proposed draft provides jurisdictions with the choice to set their GWP thresholds at 100%, 120%, or 175% of the industry average values provided in the table. These industry averages are drawn from the Carbon Leadership Forum's 2023 material baselines. Limits have similarly been passed in other jurisdictions including California; New York State; Toronto; Marin, CA; Santa Monica, CA; and the Denver Green Code. The U.S. General Services Administration (GSA) has also made strides in setting materials-based GWP limits for concrete and cement; asphalt; steel; and glass. The state of Washington has also begun to chart its own course by requiring reporting for certain materials through the Buy Clean and Buy Fair Act.

Pathway Option 3: The third pathway option takes a building-level approach, requiring the submission of a whole building life cycle assessment that indicates a 10% reduction compared to a reference building based on industry average values or based on 500 $kgCO_2e/m^2$. Other jurisdictions that have adopted this building-level approach include California, Minnesota, Toronto, and Vancouver. The 10% reduction required in the whole building life cycle assessment pathway falls within range of these precedents and others, including LEED v4.1, ASHRAE 189.1, and San Francisco's Municipal Green Building Requirements.

Determination of Compliance

The proposed appendix aims to provide a clear and simple path for code officials to determine compliance at two points along the project timeline: at the initial submission of construction documents and at the subsequent submission of amended construction documents. The role of the code official is to check for the submission of required documentation, confirm that requirements were met, and verify that the registered design professional has signed off on meeting these provisions. These efforts that fall on the design professional as well as the code official are anticipated to require minimal effort.

6. Specify what criteria this proposal meets.

- ☐ The amendment is needed to address a critical life/safety need.
- ☐ The amendment clarifies the intent or application of the code.
- ☒ The amendment is needed to address a specific state policy or statute.
- ☐ The amendment is needed for consistency with state or federal regulations.
- ☐ The amendment is needed to address a unique character of the state.
- ☐ The amendment corrects errors and omissions.

7. Is there an economic impact: ☐ Yes ☒ **No**

If no, state reason:

The legislature has mandated through HB 1282 that the embodied carbon associated with building materials be addressed; this code proposal carries out that mandate. Therefore, any responsibility to provide a robust measure of economic impact would reside with the legislature.

However, it is anticipated that the economic impact of this proposal will be insignificant.

Costs to Design Teams

A project's embodied carbon can be significantly reduced at little to no additional up-front cost.

Case studies in the Pacific Northwest have shown an embodied carbon savings potential of 19%–46% at cost premiums of less than 1%.[9] These reductions are achievable simply by specifying and substituting material alternatives with lower embodied carbon during the design and specification process. Reductions that go well beyond 50% are possible when an early, whole-building design view is considered.

These cases demonstrate that there are products and solutions available today that can realize embodied carbon reductions with low to no financial burden. In the future, these costs are only anticipated to decrease, and ultimately result in additional cost savings, as the production of low embodied carbon materials, the practice of conducting a whole building life cycle assessment, and pursuing building reuse scale up and the cost of low embodied carbon materials goes down as a result of increased practice and demand.

Costs of Code Enforcement

A study published for CALGreen's 2022 embodied carbon requirements, which includes similar reuse, materials-based, and building-level pathway requirements as this proposal, determined that there was a minor increase of costs to local governments to review and check plans for compliance with one of the three pathways.[10] There is no major fiscal impact on local governments to enforce the regulation: local governments would only need to verify results provided by applicants, in a standardized manner, to ensure compliance with the proposed pathways.

Costs to Manufacturers and Suppliers

Material manufacturers can face costs associated with the production of EPDs. However, most of the products that fall within scope of this proposal are already covered by Washington's Buy Clean and Buy Fair Act. The few outstanding products that were added to this proposal were chosen due to the fact that there already exist sufficient EPDs on the market to determine an industry-average GWP threshold.

For the most part, manufacturers and suppliers will not experience any additional burden due to the provisions of this proposal, because they are either already required to produce EPDs by state law or have already incurred the upfront costs of producing them. Smaller product manufacturers and suppliers that do not yet have EPDs may see a small financial impact from the development of EPDs for their products, but a study by Energy Transitions Commission showed that the company pass-through cost to individual projects to create the initial $5-30K EPD is negligible.[11]

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[9] Rebecca Esau, Matt Jungclaus, Victor Olgyay, and Audrey Rempher, "Reducing Embodied Carbon in Buildings: Low-Cost, High-Value Opportunities" (RMI, 2021), https://rmi.org/wp-content/uploads/dlm_uploads/2021/08/Embodied_Carbon_full_report.pdf

[10] "Economic and Fiscal Impact Statement (Form 399) Attachment C – CCRC regulations 45day" (California Department of General Services, 2022), https://www.dgs.ca.gov/-/media/Divisions/BSC/03-Rulemaking/2022-Intervening-Cycle/Public-Comments/GREEN-45-Day/BSC/BSC-04-22-399-PT11-Attachment-C-R1-45day.pdf?la=en&hash=E1121CBF2FEA6D07492DCD1E962D8AA1AFC43618

[11] Mission Possible: Reaching Net-Zero Carbon Emissions From Harder-to-Abate Sectors by Mid-Century, Energy Transitions Commission, 2018.