**CODE CHANGE PROPOSAL FORM**

**[Top section is for administrative use only; please leave blank]**

**PAGE** 1 **OF**

**CODE:**  **SECTION NO.**  **SUBCOMMITTEE AMENDMENT NO.**

**PROPOSING SUBCOMMITTEE:**  **CHAIR:**

**DATES OF PROPOSAL**: **CCCB PRESENTATION:**  **CCCB APPROVAL:**



**SUBMITTER NAME: Mark Lyles, NBI PHONE NUMBER: 503-317-5320**

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**CODE CHANGE: Please enter code change proposal on the following page using these formatting rules**

TYPE ALL TEXT IN 12- POINT TIMES NEW ROMAN FONT

~~LINE THROUGH TEXT TO BE DELETED~~

UNDERLINE TEXT TO BE ADDED

CHECK ONE ☐ Revise section to read as follows: ☐ Delete section and substitute the following:

☐ Add new section to read as follows: ☐ Delete section without substitution.



**ESTIMATED IMPACT OF CODE CHANGE ON COST OF CONSTRUCTION**

CHECK ONE ☐ Increase ☐ Decrease ☐ Negligible ☐ Unknown

Per 1,000 SF single-family dwelling       to

Per 1,000SF of commercial building       to



**JUSTIFICATION OF CODE CHANGE: Please enter justification in box below. Continue justification on following page, if necessary.**

Please reference one or more of the following criteria

☐To address a critical life/safety, health, general welfare need. ☐Address a unique character issue in the District of Columbia

☐To address a specific District of Columbia policy or statute ☐Correction of errors and omissions

☐For consistency with federal, or with MD, VA codes ☐Other (explain in justification text, below)

**Justification of Code Change:**

Appendix Z was introduced in the 2017 DC Energy Conservation Code and offers projects an alternative code compliance path that strives to achieve zero energy levels for performance. This proposal keeps a majority of the previous requirements associated with Appendix Z and seeks to simplify the performance requirements by making Zero Energy Perform Index (zEPI) the primary metric for determining compliance. The proposal includes several updates to the zEPI calculation methodology that are based on updates to Standard 189.1 and are consistent with updates being considered by Montgomery County.

Insert a new Appendix Z in the Energy Conservation Code-Commercial Provisions to read as follows:

**Redline version, comparing 2017 DC ECC-C Appendix Z to NBI proposal for 2023. Red text indicates different from 2017 App Z with highlights and strikethroughs.**

**APPENDIX Z NET-ZERO ENERGY COMPLIANCE PATH**

**Z1 GENERAL**

**Z2 MINIMUM PERFORMANCE REQUIREMENTS**

**Z3 RENEWABLE ENERGY**

**Z4 ENERGY METERING, MONITORING AND REPORTING**

**Z5 ENERGY REPORTING**

**Z6 NORMATIVE REFERENCES**

**Z1 GENERAL.** Appendix Z is intended to be an optional alternative compliance path for projects to comply with the *Energy Conservation Code-Commercial Provisions*.

The design of a *net-zero energy building* shall be achieved through the use of three complementary approaches, to be employed to the maximum extent feasible, in the following order:

1. Reducing building energy demand for heating, cooling, lighting and ventilation through the use of passive design and improved envelope performance techniques.
2. Reducing total building energy demand through the installation of high-efficiency mechanical systems, hot water systems, and power systems, lighting, and process equipment.
3. Supplying remaining building energy needs from renewable sources of energy.

Appendix Z draws on existing requirements outlined in the *Energy Conservation Code-Commercial Provisions*. Additional whole-building energy performance and airtightness testing requirements have been set to ensure new construction achieves a high degree of energy conservation.

**Z1.1. Definitions.** In addition to definitions contained in Chapter 2 of the *Building Code* and in Section 3.2 of the *Energy Conservation Code-Commercial Provisions*, the following definitions shall apply to projects opting to use Appendix Z:

**Airtightness.** The rate of air leakage through the building envelope, measured in cubic feet per minute per square foot of building envelope (cfm/ft2env), at 0.0109 psig (75 Pa) of pressure differential.

**~~Annual cooling demand.~~** ~~The total amount of thermal energy required to cool a building over the course of a year, measured in thousands of British thermal units per square foot of interior conditioned floor area, per year (kBtu/ft2 iCFA/yr).~~

**~~Annual heating demand.~~** ~~The total amount of thermal energy required to heat a building over the course of a year, measured in thousands of British thermal units per square foot of interior conditioned floor area, per year (kBtu/sf iCFA/yr).~~

**Energy Use Intensity (EUI).** The annual energy use of the building expressed in kBtu divided by gross square feet (kbtu/ ft2).

**Low-carbon neighborhood thermal energy system.** A district-scale energy system that uses acceptable sources of renewable energy per section Z3.2 to produce steam, hot water, or chilled water for the purposes of providing for building heating, cooling, and/or domestic hot water needs.

**Net-zero energy building.** A highly energy-efficient building that produces on-site, or procures through the construction of new renewable energy generation, enough energy to meet or exceed the annual energy consumption of its operations.

**Renewable energy microgrid.** (As defined by the U.S. Department of Energy) A group of interconnected loads and distributed renewable energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid.

**~~Zero Energy Performance Index (zEPI).~~** ~~A scale representing the ratio of the energy performance of a proposed design or an existing building compared to the mean energy performance of the building stock from the benchmark year of 2000 (Commercial Buildings Energy Consumption Survey, US Department of Energy, 2003 Average).~~

**Z1.2. Scope and intent.** The provisions of Appendix Z regulate the design, construction, commissioning and operation of buildings and their associated building sites for compliance with the *Energy Conservation Code-Commercial Provisions*. The intent of this Appendix is the reduction of energy use to achieve net-zero performance.

**Z1.3. Administration and enforcement.** Administration and enforcement of Appendix Z shall be governed by Chapter 1 of the *Building Code*, 12-A DCMR.

**Z1.4. Application.** The provisions of Appendix Z shall apply to each project that is new construction, or classified as a Level 3 alteration under the *Existing Building Code*, and for which this compliance path option has been chosen.

**Z1.5 Compliance.** Compliance with Appendix Z requires that the building and its site comply with the provisions of Sections Z2, Z3, Z4, and Z5.

**Z2 MINIMUM PERFORMANCE REQUIREMENTS.** Minimum performance requirements for building energy use intensity have been set to ensure maximum energy efficiency prior to adding renewable energy generation. The building and its site shall be designed and constructed to meet the mandatory prescriptive requirements in sections Z2.1, Z.2, Z.3, Z.4, and Z.5.

**Z2.1. Building energy use intensity.** Applicant shall submit, with the building permit application, *permit documents* with data and calculations sufficient to ascertain compliance with the net-zero energy performance target for buildings and their sites, using predictive modeling.

Predictive modeling shall be conducted in accordance with Normative Appendix G, “Performance Rating Method” as adopted in DC Energy Conservation Code. When using Normative Appendix G, the Performance Site *Energy* Index (PSEI) of new *buildings*, *additions* to *existing buildings*, and/or *alterations* to *existing buildings* shall be less than or equal to the Performance Site *Energy* Index Target (PSEIt) when calculated in accordance with section 4.2.1.1.. ~~and based on the use a sourcesite energy unit of measurement, expressed in kBtu/sf.ft2/yr, based on the use of the~~ *~~Zero Energy Performance Index (zEPI~~*~~)Performance Site Energy Index (PSEI) as outlined in section Z2.1.14.2.1.1~~. Appendix Z compliance, however, shall be based on the Building Performance Factors (BPF) listed in Table Z2.1.1. In a mixed-use building, all uses shall be included in demonstrating compliance, and an area weighted calculation method shall be used to account for each use.

**~~Z2.1.1.~~ ~~Zero Energy Performance Index, zEPI.~~** ~~Building design shall demonstrate a zEPI of 30 or lower as determined in accordance with Equation 1.~~

~~Performance-based designs shall demonstrate a zEPI of not more than the zEPI~~ ~~target~~ ~~for the building type as shown in Table Z2.1.1. zEPI shall be determined in accordance with the following:~~

~~zEPI = 50.4  (EUIp/EUI) (Equation 1)~~

**~~Equation:~~**

~~(Equation) zEPI = M x (Proposed building performance/Baseline building performance)~~

**~~Where:~~**

~~EUIp = The annual energy use of the building in source kBtu/ft2, for the proposed design of the building and its site, calculated in accordance with Section Z2.1.2, not taking into account any onsite or off-site renewable energy.~~

~~EUI = The annual energy use of the building in source kBtu/ft2 for a baseline building and its site, calculated in accordance with Section Z2.1.2, not taking into account any on-site or off-site renewable energy.~~

~~zEPI = zero energy performance index of the proposed building~~

~~zEPI~~*~~Target~~*~~= zero energy performance index target for compliance with this section~~

*~~Proposed Building Performance (PBF)~~* ~~= The proposed building performance in source kBtu for the proposed design of the building and its site calculated in accordance with Section 701.5.1.2~~

*~~Baseline Building Performance (BBF)~~* ~~= The baseline building performance in source kBtu for a baseline building and its site calculated in accordance with Section 701.5.1.2~~

~~M = zEPI conversion factors from a 90.1 Appendix G baseline to a CBECS 2003 baseline for the building type as shown in Table 701.5.1.~~

*~~Values in Table Z2.1.1 will be calculated by NBI based on input from TAG.~~*

**Table Z2.1~~.1~~ ~~Building Type zEPI score calculation inputs~~Building Performance Factors (BPF), Site *Energy***

|  |  |  |
| --- | --- | --- |
| **~~Building Type~~** | **~~M~~** | **~~zEPI~~~~target~~** |
| ~~Multifamily~~ | ~~78~~ | ~~42~~ |
| ~~Health~~ | ~~83~~ | ~~45~~ |
| ~~Hotel/motel~~ | ~~92~~ | ~~50~~ |
| ~~Office~~ | ~~71~~ | ~~39~~ |
| ~~Restaurant~~ | ~~92~~ | ~~50~~ |
| ~~Retail~~ | ~~61~~ | ~~33~~ |
| ~~School~~ | ~~81~~ | ~~44~~ |
| ~~Semi-heated storage~~ | ~~61~~ | ~~37~~ |
| ~~Other~~ | ~~78~~ | ~~42~~ |

|  |  |
| --- | --- |
| **Building Area Type** | **Climate Zone 4A** |
| Multifamily | 0.24 |
| Healthcare/hospital | 0.15 |
| Hotel/motel | 0.11 |
| Office | 0.31 |
| Restaurant | 0.32 |
| Retail | 0.29 |
| School | 0.15 |
| Warehouse | 0.20 |
| All others | 0.22 |

**~~Z2.1.1.1 Modeling methodology.~~** ~~The proposed building performance and the baseline building performance of the building and building site shall be calculated in accordance with Appendix G to ASHRAE 90.1, as modified by Sections 701.5.1.3 and 701.5.1.4. The energy use modeling shall include all energy used for building and site functions and anticipated occupancy.~~

**~~Z2.1.1.2 Energy units.~~** ~~The building performance calculations in Section G3 of ASHRAE 90.1 shall be based on energy use instead of energy cost. Energy use shall be converted to consistent units by multiplying the nonrenewable energy fossil fuel use at the utility meter or measured point of delivery to Btus.~~

**~~Z2.1.2 Annual Energy Use Indices.~~** ~~The EUIp of the building and building site, and the EUI, shall be calculated in accordance with Appendix G to ASHRAE 90.1-2016, as modified by Sections Z2.1.2.1 and Z2.1.2.2, and approved modeling guidelines published by the Department in administrative bulletins. The annual energy use shall include all energy used for the building systems and its anticipated occupancies.~~

**~~Z2.1.2.1 Additional Modeling Rules and Procedures~~**~~. Modeling inputs shall be in accordance with the COMNet Rules and Procedures Manual.~~

**~~Z2.1.2.2 Electricity.~~** ~~In calculating the annual energy use indices, consistent units shall be used for electric energy use, converting the electric energy use, measured at the utility meter or metered point of delivery from kWh to kBtu. KWh shall be converted to kBtu by multiplying the annual electric energy use, in kWh, by 3.412 kBtu/kWh. and multiplying the result by the dimensionless conversion factor found in Table~~

~~Z2.1.2.2.~~

**~~TABLE Z2.1.2.2 ELECTRICITY GENERATION ENERGY CONVERSION FACTOR BASED~~ ON EPA eGRID SUBREGION**

|  |  |  |
| --- | --- | --- |
| ~~eGRID 2010~~  ~~SUB-REGION~~  ~~ACRONYM~~ | ~~eGRID 2010~~  ~~SUB-REGION~~  ~~NAME~~ | ~~CONVERSION~~  ~~FACTOR~~ |
| ~~RFCE~~ | ~~RFC East~~ | ~~3.28~~ |

**~~Z2.2 Building Thermal Energy Performance~~**~~. Building thermal energy performance shall comply with Sections Z2.2.1 through Z2.2.2.~~

**~~Z2.2.1 Annual Heating Demand.~~** ~~Building design shall demonstrate a maximum annual heating demand of 4.2 kBtu/ ft2 iCFA/yr (4.8 104 kJ/m2 iCFA/yr).~~

**~~Z2.2.2 Annual Cooling Demand~~**~~. Building design shall demonstrate a maximum annual cooling demand of 6.4 kBtu/ ft2 iCFA/yr (7.3  104 kJ/m2 iCFA/yr).~~

**Z2.3. Multiple buildings on a site.** Where there is more than one building on a site, each building shall comply with Sections Z2.2.1 ~~and Z2.2.2~~ or the combined demands of all the buildings on the site shall comply with Sections Z2.2.1 ~~and Z2.2.2~~.

**Z2.3.1. Assignment of energy to multiple buildings on a site.** For building sites employing district energy systems and with multiple buildings the energy use associated with the building site shall be assigned to each building proportionally to the gross floor area of each building as a fraction of the total gross floor area of all buildings on the building site. Where energy is derived from either renewable or waste energy, or both sources, either located on the building site, within individual buildings, or on individual buildings and delivered to multiple buildings, the energy so derived shall be assigned on a proportional basis to the buildings served, based on each served building gross floor area. Energy delivered from renewable or waste energy sources located on or within a building shall be assigned to that building.

**Exception:** Where it can be shown that energy to be used at the building site is associated with a specific building, that energy use shall be assigned to that specific building.

**Z2.4. Registered design professional in responsible charge of building energy simulation.** Where the *applicant* chooses to utilize Appendix Z as the path of compliance with the *Energy**Conservation Code-Commercial Provisions*, the owner shall engage the services of, and designate on the building permit application, a registered design professional who shall act as the registered design professional in responsible charge of building energy simulation. Building energy simulation services engaged by the registered design professional shall be certified by an *approved* accrediting entity as determined by the *code official*. As authorized by the *code official*, the owner is allowed to designate a substitute registered design professional who shall perform the duties required of the original registered design professional in responsible charge of building energy simulation. The owner shall notify the *code official*, in writing, whenever the registered design professional in responsible charge of building energy simulation is changed or is unable to continue to perform his or her duties.

**Z2.5. Building Commissioning.** All systems shall be commissioned in accordance with this section and the *Energy Conservation Code - Commercial Provisions*. Energy systems commissioning and completion shall be performed for the following systems and their associated controls:

* Building envelope;
* HVAC (both mechanical and passive systems as well as HVAC controls);
* Lighting, daylighting, and lighting control systems;
* Domestic hot water systems; and
* Renewable energy systems.

**Z2.6. Airtightness Testing.** A whole building pressurization testing shall be conducted in accordance with Section XXXX ~~11.3.1.2.4(a)~~ of the *Energy Conservation Code – Commercial Provisions* to measure the airtightness of the building envelope. The owner shall verify that the airtightness specified in the final approved predictive energy model is achieved in the field by providing the *code official* with a copy of the test results before the respective the final *Certificate of Occupancy* is issued.

**Z3 RENEWABLE ENERGY.** The building and building site shall be provided with renewable energy equal to the Proposed Building Performance (PBP)~~EUIP~~ on an annual basis and calculated in accordance with Section Z2.1~~.1~~. Sources of renewable energy shall comply with Sections Z3.1 through Z3.~~3~~4.

**Z3.1. All-electric Buildings~~On-site combustion.~~** ~~On-site combustion of fossil fuels shall not be permitted for the provision of thermal energy to the building except as specified by the~~ *~~code official.~~* All *buildings* shall be *all-electric buildings* and shall comply with the standard as described in Section 4.2.

Exception to Z3.1

The following occupancies are permitted to use combustion equipment as approved by the *code official*:

a. Group A-2, Commercial Kitchens only

b. Group I-2

c. Group I-3

**Z3.2. Acceptable sources of renewable energy.** Acceptable sources of on-site renewable energy to be used on the building site include:

* Photovoltaic panels;
* Solar thermal systems;
* Wind turbines; and
* Biogas.

No other source of on-site renewable energy is acceptable for building design, unless the rationale for its selection is approved by the *code official*.

**Z3.3 On-site renewable energy.** Renewable energy shall be generated on-site wherever feasible. Before procuring off-site renewable energy, a project must demonstrate one of the following:

1. A minimum of 5% of the total building energy consumption shall first be met by an acceptable source of renewable energy installed on the building roof or site.
2. For projects generating onsite renewable energy through solar photovoltaic systems, a minimum of 25% of total site area, including building footprint, shall be allocated for photovoltaic array and energy production.

**~~Exception~~**~~: Where there is not adequate solar access as determined by Chapter 13 of the Energy Conservation Code—Commercial Provisions.~~

Exceptions to Z3.3:

1. Any building where more than 50% of the roof area is shaded that complies with section Z3.4 . Shaded areas are defined as roof area where direct-beam sunlight is blocked by structures or natural objects for more than 2,500 annual hours between 8am and 4pm.

2. Any building where more than 80% of the roof area is covered by any combination of equipment other than for on-site renewable energy systems, skylights, or occupied roof deck that complies with section Z3.4.

**Z3.4. Procurement of off-site renewable energy.** The procurement of off-site renewable energy is acceptable only where the energy is procured from a qualified electricity supplier providing energy from Tier 1 renewable sources meeting the minimum percentages of the District of Columbia Renewable Portfolio Standard. Acceptable methods for the procurement of off-site renewable energy include any of the following or as approved by the *code official*:

* Owner shall provide the *code official* with documentation of a signed, legally-binding contract to procure off-site renewable energy through a power purchase agreement for a minimum period of 5 years for electricity generation from, solar or wind-generation facilities that are located within the District of Columbia, Maryland, or Virginia. The owner remains subject to, and must comply with, the District of Columbia’s Renewable Portfolio Standard;
* Connection to a *renewable energy microgrid*; or
* Connection to a *low-carbon neighborhood thermal energy system*.

**Z4 ENERGY METERING, MONITORING AND REPORTING.**

**Z4.1 Scope.** The provisions of this Section Z4 shall apply to all projects that opted for Appendix Z as a path of code compliance.

**Z4.2. Purpose.** The purpose of this Section Z4 is to provide requirements that will ensure that buildings are constructed or altered in a way that will provide the capability for their energy use, production and reclamation to be measured, monitored and reported. This includes the design of energy distribution systems so as to isolate load types, the installation of meters, devices and a data acquisition system, and the installation of energy displays and other appropriate reporting mechanisms.

**Z4.3 Energy metering.** All forms of energy delivered to the building and building site, or produced on the building site or in the building, shall be metered and all energy load types measured.

**Z4.4. Ventilation flow rate.** In addition to requirements outlined in the *Energy Conservation Code-Commercial Provisions*, all centrally ventilated building systems shall be designed toenable the collection of real-time and historical ventilation flow rate data.

**Z4.5. Grid integration.** In places where equipment constraints in the distribution network render net metering impossible, onsite storage options shall be considered.

**Z5 ENERGY REPORTING.** Owners of buildings that used Appendix Z as a path for code compliance shall comply with this Section.

**Z5.1. Post Occupancy Measurement and Reporting.**

**Z5.1.1.** Owners of buildings that use Appendix Z as a path for code compliance shall annually benchmark and report their energy and water performance using the Energy Star® Portfolio Manager tool, including renewable energy generation and green power usage, pursuant to rules in *20 DCMR 3513,* regardless of square footage.

**Z5.1.2. Energy Star Portfolio Manager account.** The *owner* of a *building* that used Appendix Z as a path for compliance with the *Energy Conservation Code-Commercial* *Provisions* shall create an Energy Star® Portfolio Manager account and property record on the U.S. Environmental Protection Agency’s benchmarking website, and share the property with the District of Columbia’s Department of Energy and Environment. The *code official* is authorized to require proof of compliance with this Section Z5.3.1 and proof that all utilities have been linked to the account.

**Z5.2. Performance Verification.** Within 24 months of occupancy, the owner or owner’s representative shall submit documentation to the *code official* demonstrating 12 continuous months of operation with no less than 90% occupancy where the energy consumed by the building and building site as measured in accordance with Section Z4 are equal to or less than the renewable energy associated with the building and building site in accordance with Section Z3. Documentation shall be in a form acceptable to the *code official.*

**Z5.2.1. Normalization for abnormal conditions.** At the discretion of the *code official*, the owner or owner’s representative may submit documentation demonstrating that abnormal weather or occupancy conditions during the compliance period are responsible for the variance between the energy consumed by the energy and energy site and the renewable energy associated with the building and building site and that the building would comply with Z5.2 under normal conditions.